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Our Colleagues Overseas

THE Queen's gracious Christmas Day message, which forms the culmination of the "round the world" broadcast, will be listened to, among millions of Her Majesty's other subjects, by veterinarians all over the globe. In this connection it is pleasant to reflect that, among the many achievements of the British veterinary schools not the least has been their capacity to provide qualified personnel for work in the Dominions and the Colonies, in the service of friendly continental Governments, and even in some of the teaching establishments and research institutes of America.

At times our colleagues in remote parts of the Colonial Empire are called upon for personal courage and endurance of a high order, in addition to that resource and clinical skill their profession naturally requires. The columns of this journal, and of its Supplement, give ample witness, over the years, that these qualities are not demanded in vain, and it is to all distant veterinarians that we send, at this turn of the year, an especially warm greeting.

Some of the endemic diseases, and many of the clinical problems with which they have to deal are unknown in this country except through the text-books. The physical conditions of weather, and of distance, and the special difficulties posed by backward husbandry and primitive native populations are such as can hardly be grasped save through the imagination. Yet, because of the labours of these veterinary pioneers great advances are being made, and populations undernourished for generations see a new prospect before them.

THE VETERINARY RECORD has the good fortune to be read by members of the profession wherever English is spoken, and therefore we extend our greetings also to veterinarians of the sister nations of the Commonwealth, and to those in the United States of America. We welcome the communications, scientific, clinical and personal that we receive from them, we recall the pleasure afforded by their visits to successive Congresses, and we reflect, with admiration, how much the vast agriculture of their several countries owes to their knowledge and their skill.

So, in this last issue of the old year, we salute all overseas members of the B.V.A., our readers in countries throughout the Commonwealth, and our colleagues in America and all other friendly nations who may read these words.

NINTH, TENTH AND ELEVENTH CONGRESS PAPERS

Rearing Pigs

BY J. W. REID, National Agricultural Advisory Service, South-West Sub-Centre

The Nutrition of the Baby Pig

BY D. E. TRIBE, School of Veterinary Science, University of Bristol

Pig Diseases

BY H. F. HEBELER, Langport

THESE three short papers were discussed together on the morning of September 24th, the last full day of Congress. The Chairman was Mr. L. E. Perkins and the recording secretary Mr. H. S. Davies.

The Chairman, in opening the session, said that their thoughts would now be directed to that most interesting study, the rearing of pigs from birth to weaning age. It was of considerable economic importance and the farming community were very keenly interested in it. Although the mortality in the rearing of small pigs had been reduced very considerably during recent years there was still no room for complacency and losses were probably still heavier than they should be. The presentation of these three papers, each dealing with the subject from a somewhat different angle, would undoubtedly, together with the contributions which were expected to follow from the meeting, improve their overall picture of the position and would give them considerable room for further thought.

It was perhaps a little unusual that at Congress three distinct papers should be dealt with at one session, but it would be agreed that all three of them dealt with an integral portion of the same subject, and therefore no excuses were going to be made for the action taken.

He proposed that the discussion should be open to any point on any of the three papers and that the essayists should at the end of the meeting answer any questions which fell within their particular province.

Mr. Reid was to present a paper on Rearing Pigs. He had had considerable practical experience in this field in the home counties where he did a large amount of experimental work. Dr. Tribe was attached to the University of Bristol as a nutritionist, and they were looking forward to his contribution. Mr. Hebeler needed no introduction whatever to the meeting. They were very disappointed that Mr. Hebeler had not been able to be with them more during the Congress, especially as it was in his home Division, the Western Counties, but they all realised the difficulties and hoped he would have a pleasant morning with them.

Mr. J. W. Reid opened and closed his paper with a reference to the human operator in pig keeping, and he wanted to elaborate that particular aspect. The conditions under which pigs were kept all over the country were so variable that it was impossible to lay down any absolute standard for production. The adviser's task was far from easy. The first need was really to assess the human operator's potential skill and then to suggest methods and environment which would be within his capacity. But those were only the very first steps. Thereafter they had to bend their energies to ensure that the advice given was as near foolproof as possible and that its application was continuous. Keeping some form of record of performance, even on a limited scale, was an inducement to better work, but the main thing was to encourage within the man the will to achieve better results.

There was the economic aspect of rearing a sufficient number of pigs per sow per annum. The difference between 13 pigs per sow per annum and 16 or more might not amount to very many shillings per pig, but certainly in these days a saving of 2s. to 5s. a pig in the cost of production might make all the difference in the total profit, and that was another reason for concentrating on the successful rearing of pigs. That it could be done was well known.

Mr. Read said that midway through the first column of his paper he had shown that the theoretical period between litters was 172 days, and that the average period was considerably more, yet he knew quite a number of farmers who were regularly achieving a litter interval of somewhere between 171 and 173 days. If some could do it, surely other people could also do it.

Also, there were examples, probably known to many of them, of farmers who regularly achieved excellent rearing numbers per litter. One farmer in Shropshire over 17 years averaged nearly nine pigs reared with Large White sows. That was really a remarkable achievement, the overall average being very much lower.

In this job the farmer, the husbandry adviser and the veterinary practitioner all had a part to play and there was plenty of scope for each.

MR. REID'S PAPER

The paper, which had been circulated previously, was as follows :—

REARING pigs is a co-operative enterprise between the breeding sow and the human operator. Unless the first is selected from proven lines both as regards fecundity and type, and the second provides the most desirable environment and exercises a high degree of managerial skill, results are likely to be disappointing.

The aim should be for each sow to rear not less than 16 pigs per annum, weaned at eight weeks old at a weight of not less than 30 lb. What is achieved in practice and how may that achievement be improved?

One of the difficulties in discussing this subject is the paucity of factual information, and such information as is available tends to come from herds where the standard of management is reasonably good. It may well be, then, that the figures quoted show a position somewhat better than the overall one for the industry.

So far as number of pigs born and weaned is concerned there is more information available than for other factors. From data collected pre-1939 the average results of pig recording societies was around 10.5 born and 8.0 reared per litter. The results from the Bucks Pig Recording Scheme, 1949-1952, were:

	No. of litters	Born	Weaned
1949	378	9·95	7·49
1950	545	10·25	8·25
1951	696	9·56	7·66
1952	845	9·7	8·1

Wastage between birth and weaning averages somewhere around 24 per cent.

The number of pigs weaned per sow per annum and their condition at weaning is of much greater economic importance than results from single litters and is a better measure of managerial skill. On paper a sow should be capable of weaning two litters each of eight pigs within 12 months. The calculation is simple, *viz.* :

Gestation period	112 days
Suckling period	56 ,,
Weaning to mating	4 ,,
	172 ,,

There is thus 21 days to spare, and since the sow comes on heat at 21-day intervals, this timetable permits one lapse in service each year. That is the theory; what are the facts?

Records from 1,623 litters in Hertfordshire (1933-1938) show the average interval between litters to be 191 days. On the calculation it would be possible to rear 16.6 pigs per sow per annum; on the recorded facts the average reared is 15.3. The implications are clear.

A number of factors influence wastage. Large litters are subject to heavier losses than small litters, because they increase the risk of loss owing to the larger number of pigs involved; but there can be no satisfaction in achieving a low rate of wastage through small litters. No sow should be used for breeding unless she is equipped with 12 sound teats and the potential of the sow for rearing litters of from 10 to 12 pigs is a challenge to management.

Most sows shed at each heat period sufficient ova to provide litters of 20 and only a few less than 12, and while a number of embryo pigs undergo atrophy in the uterus, the Hertfordshire records showed that in only 13.5 per cent. of all litters were less than eight pigs born alive.

A successful mating is, of course, the first factor in rearing a good litter, and small litters may be due to mating too early or too late in the heat period or to using a boar, and especially a young boar, at too frequent intervals. Both these causes are within the scope of management and the skilled pigman will guard against them.

It is a well-known fact that certain sows and certain families consistently rear more and better pigs than others, and although there is no definite evidence that mothering ability is inherited, many breeders believe this to be so. Mothering ability may be said to be a composite of many qualities, including temperament, milking capacity, carefulness of movement. Selecting gilts for breeding from proven strains may reduce the risk of wastage.

Causes of Wastage

Such information as is available indicates that wastage is higher in the winter months than in the summer months. Thus in the East Anglian Pig Recording Scheme survival rate was highest in the months of April-September inclusive, and in the Hertfordshire records wastage during May, June and July averaged 19 per cent., compared with an average of 28 per cent. during December, January and February. Recent investigations on temperature adjustment in the young pig emphasise the significance of these observations.

Where it has been possible to ascertain actual causes of death between birth and weaning, it is shown that more than 50 per cent. are due to crushing by the sow and that the majority of deaths from this cause occur in the first three days after birth. The physical act of crushing may be brought about by a number of factors, *e.g.*, temperament and clumsiness on the part of the sow, but the primary cause is no doubt due to the desire for warmth on the part of the little pig which keeps it in the closest proximity to the sow.

Deaths from pneumonia, colds, and scour appear to account for about 15 per cent. of the wastage (Cambridge 1936-37), but since the disease factor is likely to be important only on few farms, the average figure may be misleading. Other causes of death are varied, but on average insignificant.

Body temperature development of baby pigs was studied under various conditions of environmental temperature by workers at the Michigan Agricultural Experiment Station (1951). The body temperature regulating mechanism in the newborn pig is not fully developed and in the first 30 minutes after birth the body temperature drops from 3° to 13°F, depending on the size of the pig and the

environmental temperature. The initial drop was followed by a gradual return to normal which in environments of 60° to 75°F was reached in about 48 hours and in environments approaching freezing temperatures was reached in about 10 days. There was a significant correlation between the weight of a pig and its ability to adapt itself to its environment. Small pigs in a fasting state passed into a coma sooner when chilled than pigs of comparable size having access to sow's milk.

It is clear that the maintenance of a suitable temperature in farrowing houses is of major importance in rearing satisfactory litters since cold and especially damp cold is a primary cause of wastage. But there is no agreement on the ideal temperature. Everyone agrees, however, on the need to maintain a constant temperature and to avoid sudden changes in temperature at all stages of growth. The available evidence shows that warmth is of greatest importance in the early days of life and that as the pig grows older the effect of temperature on health diminishes, although it may still influence rate of growth.

The temperature of the farrowing pen should not be allowed to fall below 65°F, and probably should be maintained around 70°F.

Conservation of Temperature

The establishment and maintenance of a suitable temperature depends on the production of the necessary heat and the prevention of its loss from the building. The cheapest source of heat is obviously to use the body warmth of the pigs themselves, but this is impossible with large air spaces and difficult at farrowing time when the body heat given off from the sow is low. Hence the need for some form of artificial heating such as hot water pipes, overhead infra-red lamps or electrical floor warming units. We are only now beginning to appreciate the need to conserve heat. The value of insulating the floor has long been recognised, although not always practised. It is equally essential to insulate walls and roofs, and windows should be kept to a minimum or double glazed.

One of the reasons why well-designed arks or huts have given good results is because in them it is possible to maintain, without artificial aid, a satisfactory temperature. That these huts may be used even in cold climates is shown by the very good results obtained under an outdoor system on the Rowett Institute Farm, Aberdeenshire. At the other extreme, in the moist climate and windswept country of Cornwall, where excellent results are being obtained in similar huts at Rosewarne Experimental Horticultural Station. My personal preference is to farrow outdoors in huts except where the soil conditions make this virtually impossible. In the colder areas of the country it is a sound plan to use well-insulated draught-proof types of hut. Outdoor farrowing systems generally facilitate the rearing of good healthy litters.

Where circumstances demand, or personal preference desires an indoor farrowing system, there are a number of designs for houses to choose from. The most advanced thought favours pens where the sow and litter are entirely enclosed in a single unit, thus lessening the risk of disease being transmitted from pen to pen. Any permanent farrowing house should be fitted with farrowing rails and a "creep" where some form of artificial heating may be provided in early life and where later the little pigs may be given food away from the sow.

Housing, however, is only one factor in obtaining good results. Management, feeding, hygiene, all play a part, and the level of production is determined by the weakest point in the whole organisation.

About a week before she is due to farrow the sow should have her udder washed with warm water and soap and then be placed in well cleaned and thoroughly disinfected farrowing quarters littered with clean short wheat straw. The sow should be handled regularly during pregnancy so that she is accustomed to the pigman and has confidence in him, then if assistance is necessary at farrowing the presence of the pigman is less likely to disturb the sow. Normally such assistance is not required.

Feeding the Litter

For the first three or four weeks of their life the litter will depend for food entirely on the milk produced by the sow, hence the need for proper feeding and exercise to maintain the milk supply. With litters born and reared indoors precautions should be taken against anaemia. As soon as the little pigs will take to it, usually at some time after the second week, creep feeding should be practised. Creep-fed pigs wean at heavier weights than those not so fed, and are less liable to post-weaning checks. Even under all-round good conditions of management creep-fed pigs should be some 7 to 10 lb. heavier than those relying entirely on the milk from the sow.

When eight weeks old the litter should be weaned. This is best done by removing the sow and leaving the litter some time longer in the pen which is familiar to them.

Boar pigs should be castrated when three or four weeks old; it is bad policy to leave this operation to a later date.

There is no mystery about rearing good litters, neither is there any panacea which will secure good results with minimum endeavour. Each detail of management has to be studied and applied with vigour. In the great majority of cases it is the human factor which makes or mars success. One wonders how long the industry can afford to lose such a high proportion of young pigs born. Undoubtedly there is great scope for improvement, and to achieve it all who can influence the methods practised have a great opportunity.

Summary

The aim should be to rear not less than 16 pigs per sow per annum; practice falls short of this test of managerial skill. Wastage between birth and weaning averages 24 per cent. Factors affecting wastage are numerous; possibly the best preventive is the maintenance of an adequate temperature in the farrowing pen. Some form of artificial heating may be necessary, but attention must be paid to conserving heat through proper insulation of build-

ings. There is no mystery about rearing good litters, but each detail of management has to be studied and applied with vigour.

Dr. Tribe, demonstrating his introduction with slides, said: The heavy mortality rate in baby pigs between birth and weaning has been stressed in all three papers and I do not now wish to refer to it further except as an urgent and economic justification for an intensive experimental investigation into the physiological and nutritional requirements of the young pig. At last we have available an experimental technique which makes such a systematic investigation possible. The general outline of the artificial rearing of baby pigs on synthetic diets is contained in the precirculated paper, but I would like to amplify this description with a couple of photographs. The first slide (Plate 1) shows the type of cage which we use at the Langford Veterinary Field Station for housing pigs when 24 hours old. These are actually converted rabbit cages measuring 17 by 24 by 16 inches. The cage front acts as a door and is hinged at the top, while at the bottom is a trough to which the pig may be allowed access by a slight adjustment of the hinge. By keeping the pig individually caged it is possible to obtain every control over its food and water intake, as well the degree of isolation which is so desirable for work on problems of virology, bacteriology or parasitology. If the pig is to be considered as an experimental small animal it is very necessary that the routine of its management should not be too expensive and it must be easily within the limits of a normal animal attendant. I want to stress that these conditions are fulfilled in the dry feeding method from seven days onwards which is outlined in my paper. The second slide (Plate 2) shows a group of four-week old pigs operating their dry feed self-feeder. These pigs have been reared on a synthetic diet since they were 24 hours old. These self-feeders have been made to our own design by S. M. Wilmott & Co., and I would like to acknowledge our indebtedness to their staff.

The application of this technique upon farms depends, in my opinion, upon the evolution of a satisfactory, cheap, dry, meal mixture. If able to buy such a food from his feeding-stuffs merchant, and able to purchase a suitable self-feeder for only a very few pounds, then it is no bother or expense for the farmer to rear his orphan litters or surplus piglets. Indeed his only other requirement is a small wooden or concrete pen and the infra-red heating lamp. In this way it would be worth while applying this method immediately on most pig farms. Whether the routine weaning of normal litters from healthy sows at an exceptionally young age is yet worth while seems to me doubtful. That it may be so in a few years, however, remains a distinct possibility. For this to happen would depend upon two things. Firstly, a really first-rate meal mixture based upon reliable knowledge of a piglet's nutritional requirements must be produced at an economic price by the compound feeding-stuffs firms. Secondly, since one of the main advantages of the system lies in the theoretical possibility of obtaining three litters per year from each sow, a great deal more must be discovered about the occurrence of oestrus in the sow following parturition, and of the factors which influence it. From existing evidence it seems that most sows come on heat two or three days after farrowing, but at this time the great majority do

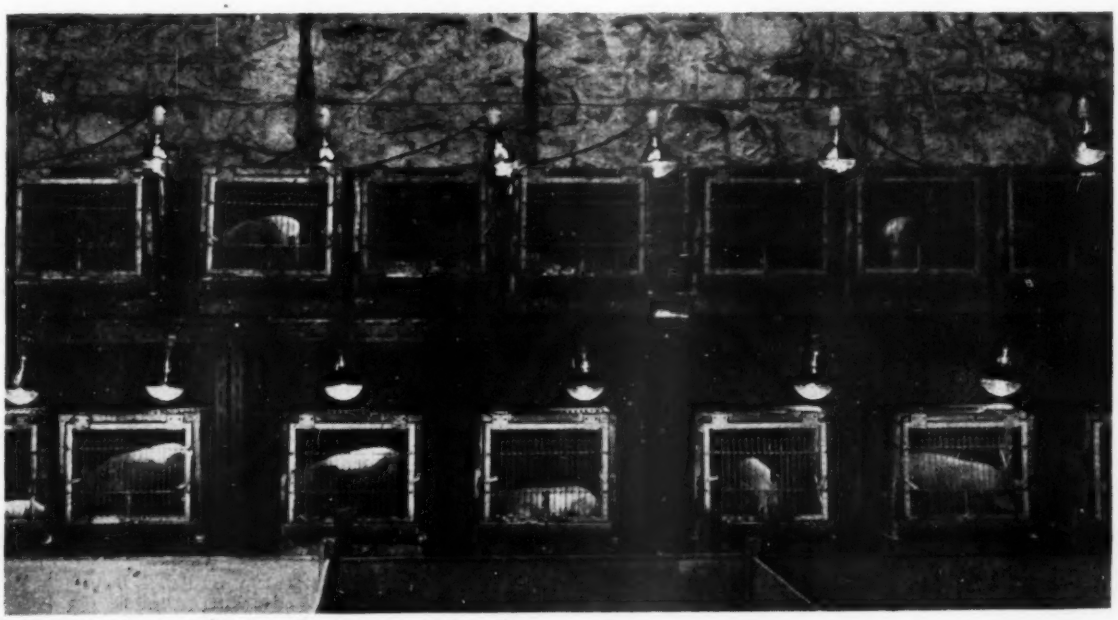

PLATE 1.—Showing the type of cage in which pigs are housed when 24 hours old at Langford Veterinary Field Station.

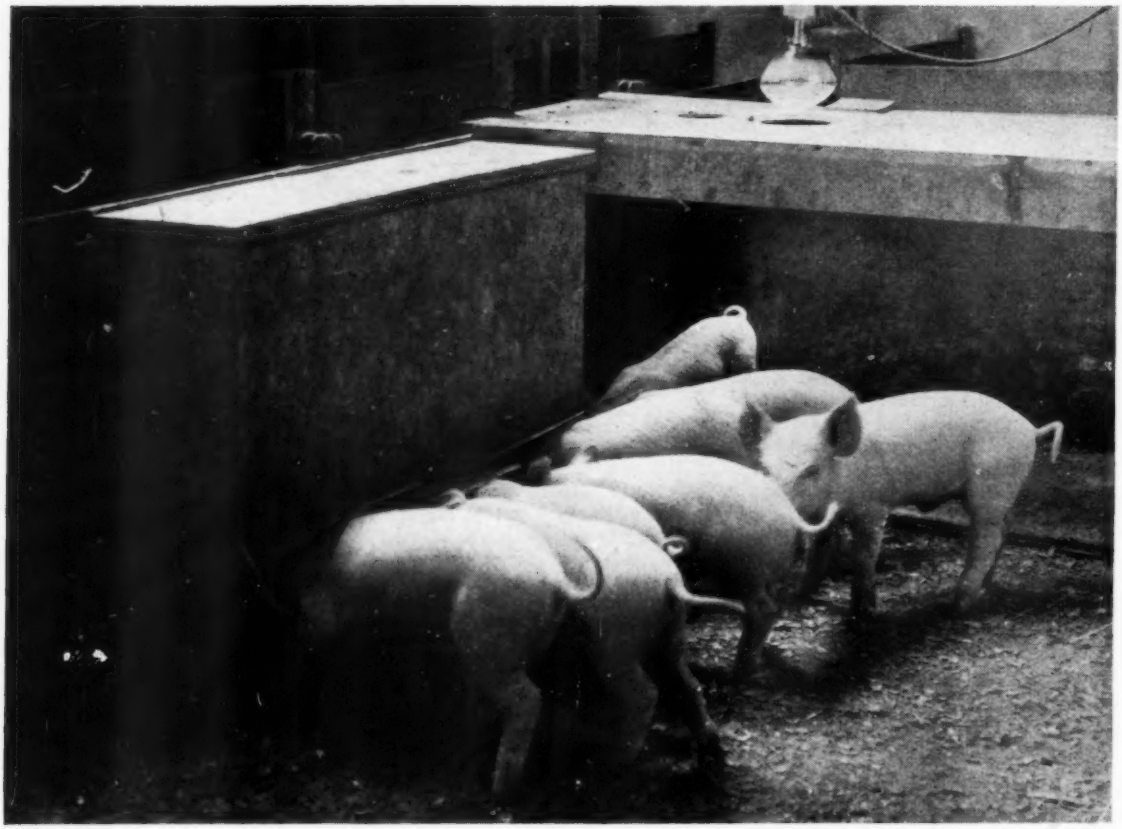

PLATE 2.—Showing a group of penned pigs operating their dry feed self-feeder.

not in fact ovulate. Most pigs then exhibit an ovulatory heat again between about the 8th to 21st day after parturition (Warwick *et al.* 1950; Baker *et al.* 1953). If this is the case there can be no advantage in weaning the litter in order to return the sow to the boar before the seventh day, and probably in practice the 10th day would be satisfactory. In this case the piglets may be weaned directly onto dry food and they tend then to reap the benefits of the sow as well as those of artificial rearing. Recently we carried out this method with 30 pigs, the oldest of which are now four weeks old, and we have found that at 28 days they averaged a little over 14 lbs. in weight, which, by referring to Table III in my paper, you will find is better than we normally get at this age with artificial rearing. We hope that the weights at eight weeks old will therefore be further improved. Incidentally it is worth remarking that we have encountered no trouble in drying off the sows after they have been lactating for as long as 10 days.

Experimental Work Described

But primarily the importance of this technique is as an experimental tool and I want to finish by telling you of some experimental work which is now in progress at Langford House. It is, of course, extremely dangerous to talk of experiments that have not yet finished, but I have been told that you like a little target practice at your Congresses and that it is understood that the more guest speakers expose their vulnerable parts to be shot at the jollier the Congress is.

When we started weaning pigs at 24 hours old we were naturally concerned to take steps to prevent them developing iron deficiency anaemia, and for ease of manipulation we adopted as a preventive measure three injections each of 100 mg. of iron (as ferric phosphate in suspension) at weekly intervals, the first being at 48 hours old. It was soon noticed that this method was not entirely satisfactory and several pigs showed characteristic symptoms of piglet anaemia. When, instead of injections, ferric citrate was added as a supplement to the synthetic diet at a rate of 0.2 per cent. no symptoms of anaemia occurred and the rate of live-weight gain was increased. An illustration of our results is given in Fig. 1. This shows the average growth curves of a litter of seven pigs whose only source of iron was injected ferric phosphate. At eight weeks of age the average bodyweight was 10.2 lbs. At nine and a half weeks three pigs were killed and *post-mortem*

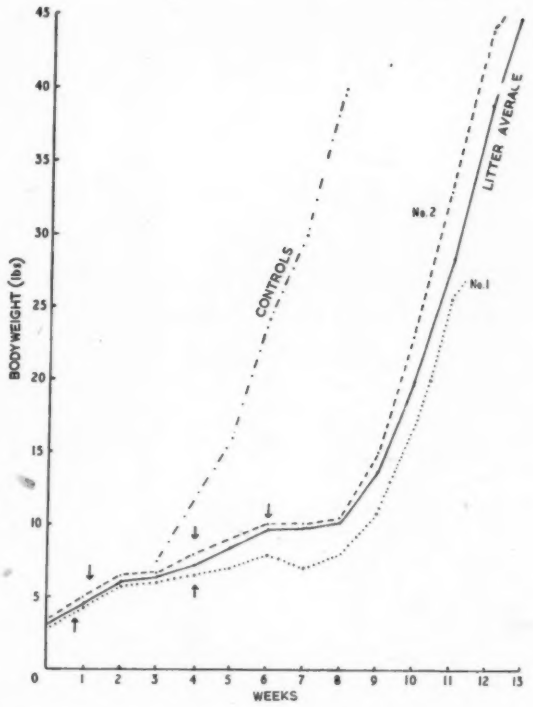

FIG. 1.—Showing the response to injected ferric phosphate of pigs maintained on an iron-deficient diet. The average growth curve for a litter of seven pigs is shown thus ————, while curves for two individuals of this litter, Nos. 1 and 2, are shown thus ..... & — — — — — — —. The arrows indicate injections of 100 mg. iron. The average growth curve of 40 control pigs given iron by mouth is shown thus — . — . — . — .

examination confirmed that they were suffering from piglet anaemia while the iron contents of their livers (4.25, 3.1, and 6.1 mg. Fe per 100 g. liver) were all below the normal range. When 10½ and 11½ weeks old two further pigs died of piglet anaemia but the two remaining animals progressed until slaughtered at bacon weight. Fig. 1 makes it clear that there was no live-weight response to the injected iron, but although no further iron was given at all and the pigs continued on the iron-deficient synthetic diet until 16 weeks old, there was a remarkable increase in growth after the eighth week. Fig. 2, which gives the haemoglobin levels (Sahli's method) of these pigs, shows that these only returned to normal levels at about the 11th week. What such results as these mean I cannot at the moment say, but I have shown them to you because I would welcome your suggestions and because I think that this is a good example of the experimental possibilities of the early weaning technique. Previous work on piglet anaemia, for example, has been hampered by the necessity of keeping the piglets with their sows, and the features which we have experienced have not been reported previously because pigs have not previously been kept on iron deficient diets for as long as 16 weeks.

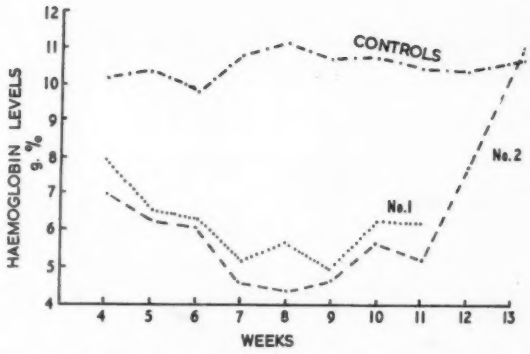

FIG. 2.—Showing the haemoglobin levels (g. per cent.) of pigs Nos. 1 and 2 which received ferric phosphate by injection and the average levels for the control pigs which received iron by mouth.

References

BAKER, L. N., WOEHLING, H. L., CASIDA, L. E., & GRUMMER, R. H. (1953). *J. Anim. Sci.* **12**. 33.
WARWICK, A. C., CASIDA, L. E., & GRUMMER, R. H. (1950), *Ibid.* **9**. 66.

DR. TRIBE'S PAPER

THE scope of this paper is limited to a few observations concerning the nutrition of the piglet, *i.e.*, the baby pig from birth to weaning at eight weeks old. This period is undoubtedly the most hazardous of a pig's life for it is during this time that mortality rates are disconcertingly high.

Pre-weaning Losses

Table 1 (overleaf) gives the estimated pig losses for Australia, Canada, New Zealand, England and America. From these figures it will be seen that for every ten pigs born approximately eight only are weaned, and losses of this order have also been reported from Sweden (Dyrendahl *et al.*, 1953).

Menzies-Kitchin (1937) analysed mortality data from nearly 2,000 litters produced on about 20 farms during the period 1927-31, and concluded that in addition to important breed differences the percentage death-rate prior to six weeks of age increases with the age of the sow, the number of pigs in the litter, and the onset of winter. An analysis of Australian figures according to districts shows that losses are greatest in the wheat belts and lowest in those areas in which dairy farming predominates.

The relative importance of the various causes of actual death is difficult to assess but it has been estimated that in Queensland 50 per cent. of deaths are due to overlaying by the sow, 10 per cent. are due to scours, 10 per cent. are due to an insufficiency of milk, and the remaining 30 per cent. are due to runts, pneumonia, accidents, etc. Menzies-Kitchin (1938) investigated the causes of death of 1,483 piglets in the Eastern Counties and his analysis is summarised in Table 2. It will be seen from this that his figures agree substantially with those for Queensland and there is no doubt that the overlaying of the sow is easily the most important single contributory factor.

TABLE I

ESTIMATED PIG LOSSES FOR AUSTRALIA, CANADA, NEW ZEALAND ENGLAND AND AMERICA

Country	Pre-weaning Loss Average No. of Pigs per Litter Born	Weaned	Lost	% Lost	Post-Weaning % Lost
Australia[1]:					
Spring 1951	9·3	7·2	2·1	22·5	3·4
1952	9·3	7·3	2·0	21·5	
Autumn 1952	9·1	7·3	1·8	19·9	
1953	9·1	7·2	1·9	20·9	
Canada[2]:					
Spring 1951	9·6	7·8	1·8	18·7	
1952	9·2	7·5	1·7	18·5	
Autumn 1950	9·7	8·2	1·5	15·5	
1951	9·4	7·9	1·5	15·9	
New Zealand[3]					
1949–50	9·0	6·9	2·1	23·3	
1950–51	9·1	6·8	2·3	25·2	
England[3]:					
(Eastern Counties)					
1937	9·4	7·7	1·7	18·1	
U.S.A.:					
1947[4]	—	—	—	33	10
1937[5]	—	—	—	40	

[1]Pig Crop Report, June, 1952, *Bur. Agric. Econom., Canberra*, p. 18. Pig Crop Report, December, 1953, *Bur. Agric. Econom.*, Canberra, p. 10.

[2]The Pigmeat Situation, December, 1953, *Bur. Agric. Econom.*, Canberra, p. 24.

[3]Menzies-Kitchin, A. W., 1938, *Pig. Breed. Annu.*, **18**. p. 35.

[4]Research and Marketing Proposals for the Livestock Industry. U.S.D.A., Report, 1947.

[5]Smith, W. W., 1937, Pork Production, p. 66, The MacMillan Co., New York.

TABLE II

ANALYSIS OF PRE-WEANING MORTALITY (MENZIES-KITCHIN, 1938).

Cause of Death	Number	Per Cent.
Overlaid by sow...	722	48·7
Bad doers	327	22·1
Scour	135	9·1
Insufficient milk	119	8·0
Pneumonia and colds	77	5·2
Savaged by sow	28	1·9
Accident	20	1·3
Miscellaneous causes	42	2·8
Not recorded	13	0·9
Total Number of Observations	1,483	100·0

However, it is unsatisfactory to attribute overlaying merely to the shortcomings of a clumsy sow. As Fishwick (1945) has observed, when piglets are lain upon it is very often the consequence of their own behaviour and not that of the sow. This slowness of reaction may be due either to undernourishment caused by an inadequate milk supply or to a low virility resulting from a low-plane of foetal nutrition. It is unfortunately true, however, that apart from these rather general observations extremely litte is known concerning the particular nutritional factors which contribute towards the health or disease of the piglet.

The main reason why so little is known concerning the baby pig's nutritional requirements is that in the interests of its survival it has traditionally been necessary to keep it with its dam for at least the first four or six weeks of life. This has seriously restricted the use of piglets as experimental animals and has meant that their intake of nutrients has largely been derived from their dam's milk and has therefore been of an unknown quantity and quality. It was not until comparatively recently that a technique was evolved for withdrawing milk from sows in sufficient quantities for detailed analysis (Braude *et al.*, 1947). This important step forward made it possible to carry out systematic studies on the composition of sows' milk and colostrum and of the factors which influence it (see *e.g.* Bowland *et al.*, 1949; Heidebrecht *et al.*, 1951). However, it should be remembered that nature is not infallible, and the teleological argument that the composition of a sow's milk exactly reflects the nutritional requirements of the piglet is not supported by the evidence. For example, the vitamin C content of sows' milk is unusually high (Braude *et al.*, 1947) and yet it has been shown that the baby pig is in no way dependent upon a dietary source of this vitamin since even from one day old it is able to satisfy its own requirements by intestinal synthesis (Braude *et al.*, 1950). A better-known argument of the same sort concerns iron, for which the piglet has a high requirement and yet sows' milk contains extremely little.

The Baby Pig as a Laboratory Animal

It is clear therefore that before much information concerning the baby pig can be obtained a technique for treating the piglet as an experimental animal must be evolved. To do this means that synthetic diets must be adapted for the use of pigs in the way that they are customarily used with laboratory animals. Cambridge workers (Chick *et al.*, 1938) were the first to employ purified diets successfully in the experimental feeding of pigs but they used post-weaning animals and it was not until some years later that American workers interested themselves in the use of synthetic milks for raising the very young pig (McRoberts & Hogan, 1944; Bustad, Ham & Cunha, 1948). These first attempts were not successful but very soon piglets which had received colostrum for a minimum of 24 hours were successfully raised on a synthetic milk which contained 30 per cent. vitamin-free casein, 37.4 per cent. cerelose, 26.6 per cent lard and 6 per cent. mineral salts plus 14 different fat-and-water-soluble vitamins (Johnson *et al.*, 1948). This advance now opened the way to an intensive and detailed study of the nutritional requirements of baby pigs and during the last three or four years reports of many such experiments have appeared in the American literature (see *e.g.* Wiese *et al.*, 1951; Lehrer & Wiese, 1952; Sewell *et al.*, 1953; Schendel & Johnson, 1953a,b). It is not within the scope of this paper to review the findings of these workers; instead I wish to mention briefly some of the experiences which we have encountered at the University of Bristol Veterinary School where, during the last year, M. R. McCrea and myself have been rearing

pigs from one or two days old on experimental diets. It was at the suggestion of Dr. J. A. Laing that this work was started and we would like to acknowledge his very considerable help in initiating it.

Details of Diet

Since September, 1953, 150 pigs have been removed from their sows and 85 per cent. of them have been raised successfully to eight weeks of age. At first the example of earlier workers was followed, particularly that of Dyrendahl (1953), and a synthetic liquid milk based largely upon reconstituted dried skimmed milk and lard was used. When supplemented with vitamins and minerals this diet gives good results, the pigs reaching 30 lb. live-weight in about 50 days. Unfortunately, however, this method has several disadvantages most of which are associated with its demands on labour and time, and the difficulties of mixing and feeding a diet high in lard. To simplify these aspects of the technique the following method has now been evolved which is satisfactory from most points of view, although many details have yet to be settled. The baby pigs are not removed from the sow until the second or third day of age since, although it is possible to rear piglets even without colostrum (Young & Underdahl, 1951), if there is no need to do so from the point of view of the experiment it is certainly easier to allow the sow to suckle the litter for the first 24 to 48 hours. The pigs are then removed and either individually caged or placed in communal pens. In either case heat is provided by 250 watt infra-red lamps giving a floor temperature of approximately 25°C., and the experimental diet is offered as a thin paste, mixed with cows' milk for the first two to three days and with water for the next three to four days. If upon removal from the sow the piglets are starved for from four to six hours and then forcibly introduced to the mixture by repeatedly having their noses dipped into it they rapidly learn to lap it up from an open trough. At first the liquid food was heated approximately to body temperature, but experience showed that this was not necessary and now it is routinely fed cold from the beginning. During the first seven days of the experimental routine the thin paste is gradually stiffened off, and on the eighth day it is omitted altogether and the dry meal and water are then offered without stint in separate containers. It is important that both the dry meal and the water should be offered even during the first seven days for the piglets will drink water in large amounts from the start and the meal is nibbled at in increasing amounts from about the fourth day. Once on to the dry food the piglets readily learn to use a self-feeder type of trough and the subsequent management is thus both straightforward and labour saving.

The type of diet which we have found to be successful consists of: sucrose 40 per cent., maize starch 20 per cent., dried yeast powder 3 per cent., dried whole milk powder 10 per cent., casein 22 per cent., and a mineral mixture 5 per cent. The mineral mixture in use at the moment is a slightly modified version of McCollum's salt mixture No. 185 and consists of: ferric citrate 6.4 per cent., sodium chloride 4.5 per cent., magnesium sulphate 11.0 per cent., sodium dihydrogen phosphate 9.0 per cent. potassium phosphate 24.7 per cent., calcium phosphate 14.0 per cent. and calcium lactate 30.4 per cent. In addition to this ration a stable mixture of vitamins A and D are added to give 1,600 I.U. vitamin A and 400 I.U. vitamin D for each 100 g. of diet; 100 μg. of vitamin B_{12} is injected intramuscularly into each animal at 3, 10, and 17 days of age, and procaine penicillin G is added at a level of 0.003 per cent. of the diet.

With this diet the pigs average 30 lb. at about 49 days and at the customary weaning age of 56 days they weigh about 40 lb. which compares favourably with the 30 lb. live-weight which is to be expected at eight weeks under normal systems of rearing. There are, however, important differences in the growth curves of naturally and artificially reared pigs and these are reflected in Table 3 which compares average weights under the two systems. For the first three or four weeks the sow's method is superior, but thereafter the artificially reared pig puts on weight very rapidly, and by the sixth week overtakes those which are naturally reared.

TABLE III

AVERAGE WEEKLY WEIGHTS DURING PRE-WEANING PERIOD

Age in Weeks	Normal Rearing (Quoted by Davidson, 1948) (lb.)	Artificial Rearing (lb.)
Birth	2·5	2·5
1	5·5	4·0
2	9·0	5·5
3	11·0	7·0
4	14·5	10·5
5	17·0	16·0
6	21·0	24·0
7	24·0	30·0
8	28·2	40·0

Although our attention has so far been concentrated upon the evolution of a satisfactory technique for the experimental management of baby pigs one or two incidental observations are of interest.

At first iron was not included in the mineral supplement of the diet but instead the equivalent of 100 μg. of iron was injected intramuscularly at 3, 10 and 21 days of age. It was found that very few animals were able to utilise iron administered in this manner and the majority became profoundly anaemic and died. A few pigs given iron by injection showed the characteristic anaemia but did not die. At eight weeks of age these animals weighed an average of only 10.2 lb. and had an average haemoglobin level of 5 g. per cent. Although no change whatever was made in their diet, and no further administration of iron in any form was given, they then began to improve in condition until by 10 weeks of age they averaged 20 lb. and at 14 weeks 41 lb. During this time also the blood picture slowly returned to normal. We can offer no explanation for these observations at the moment but hope that future results will help us to understand them. When iron was given by mouth no anaemia occurred even though the diet used contained no copper supplement.

It will be observed that no vitamin E supplement is included in the experimental diet. This is an omission which perhaps should be rectified. It has been found that if the experimental diet is fed only for the first six or eight weeks and the pigs are then given normal farm foods no advantage in terms of live-weight increases results from feeding α-tocopherolacetate. If, however, the pigs are maintained on the experimental diet after eight weeks of age they may die if vitamin E supplements are withheld. On *post-mortem* examination such pigs may show typical lesions of muscular dystrophy in the muscles of the hind limbs, or more usually heart failure with changes in the myocardium.

One of our experimental diets included 10 per cent. dried yeast powder and, as has previously been reported by Braude *et al.* (1943), it was found that in spite of levels of vitamin D in the diet which would normally be considered adequate the pigs developed rickets. The condition became obvious between 7 and 10 weeks of age and was cured by a change to a diet containing low levels of yeast and injections of vitamin D_3. At the 3 per cent. level dried yeast produced no untoward effects.

The Farm Application of Artificial Rearing

Considerable publicity has been given to the possibilities of adopting artificial rearing as a regular farm practice. The theoretical advantages to the farmer of such a technique are as follow :—

1. The possibility of rearing three litters per sow per year, since the 16 weeks now spent every year suckling two litters will be saved.
2. Pre-weaning losses will be reduced and all "surplus" pigs saved since there will be an adequate quantity and quality of food provided for every individual animal and disease control may be improved.
3. Weaning weights will be higher and time taken to reach bacon weight reduced.

In spite of these tempting advantages, however, it must be admitted at the outset that in view both of the novelty of the system and our comparative ignorance concerning it (particularly concerning its long-term effects on the sow) farmers would be well-advised to treat the development with caution. From experience so far obtained it is clear that expensive "artificial sows" which supply a heated synthetic milk through a row of teats are not necessary for satisfactory results. A dry meal supplied in a small self-feeder from 7 to 10 days of age onwards is probably the most economical system of feeding. Since experience has shown that artificially reared pigs never grow as well as naturally reared littermates for the first two weeks it has occurred to us that perhaps the best way of adapting the principles of artificial rearing to practical conditions is to wean the pigs at 10-14 days old. This means that they then receive the early advantages of the sow's milk, and also they may be given dry food immediately artificial rearing is commenced. Very satisfactory results have been obtained from the small number of pigs which we have reared in this way. An experiment published recently by Crampton & Ness (1954), which involved 196 pigs, demonstrated that pigs weaned at 10 days of age and then self-fed a dry meal will develop at least as well as sow-nursed pigs of comparable breeding. It must be remembered, however, that just as with other forms of intensive livestock management the successful artificial rearing of baby pigs demands above all a high degree of interest and skill from the stockman.

Summary

The period between birth and weaning is the most critical in the life of a pig for it is at this time that the mortality rate is about 20 per cent. Our knowledge of the nutritional requirements of the baby pig is limited since it is difficult to carry out experimental investigatons prior to weaning. A recent development in which baby pigs are weaned from their dams at 24-48 hours of age is described and its importance as an experimental technique is stressed. The possible application of this method of rearing under practical conditions is discussed.

References

BRAUDE, R., KON, S. K., & WHITE, E. G. (1943). *J. Comp. Path.* **53.** 161.

BRAUDE, R., COATES, M. E., HENRY, K. M., KON, S. K., ROWLAND, S. J., THOMPSON, S. Y., & WALKER, D. M., 1947, *Brit. J. Nutrit*, **1.** 64.

BRAUDE, R., KON, S. K., & PORTER, J. W. G. (1950). *Brit. J. Nutrit.* **4.** 186.

BOWLAND, J. P., GRUMMER, R. H., PHILLIPS, P. H., & BOHSTEDT, G. (1949). *J. Anim. Sci.* **8.** 199.

BUSTAD, L. K., HAM, W. E., & CUNHA, T. J. (1948). *Arch. Biochem.* **17.** 249.

CHICK, H., MACRAE, T. F., MARTIN, A. J. P., & MARTIN, C. J. (1938). *Biochem. Jour.* **32.** 2207.

CRAMPTON, E. W., & NESS, O. M. (1954). *J. Anim. Sci.* **13.** 357.

DAVIDSON, H. R. (1948). "The Production and Marketing of Pigs. Longmans, Green & Co., p. 439.

DYRENDAHL, S. (1953). *Proc. XVth Intl. Vet. Congress.* Pt 1. **2.** 203.

———., SWAHN, O., BJORCK, G., & HELLVING, L. (1953). *Acta Agric. Scandinavica.* **3.** 334.

HEIDEBRECHT, A. A., MACVICAR, R. W., ROSS, O. B., & WHITEHAIR, C. K. (1951). *J. Nutrit.* **44.** 43.

JOHNSON, B. C., JAMES, M. F., & KRIDER, J. L. (1948). *J. Anim. Sci.* **7.** 486.

LEHRER, W. P., & WIESE, A. C. (1952). *J. Anim. Sci.* **11.** 244.

MCROBERTS, V. F., & HOGAN, A. G. (1944). *J. Nutrit.* **28.** 165.

MENZIES-KITCHIN, A. W. (1937). *J. Agric. Sci.* **27.** 611.

———. (1938). *Pig. Breed. Ann.* **18.** 35.

SCHENDEL, H. E., & JOHNSON, B. C. (1953a). *J. Anim. Sci.* **12.** 84.

———., & ———. (1953b). *Ibid.* **12.** 88.

SEWELL, R. F., SHEFFY, B. E., EGGERT, R. G., & LOOSLI, J. K. (1953). *J. Anim. Sci.* **12.** 597.

WIESE, A. C., LEHRER, W. P., MOORE, P. R., PAHNISH, O. F., & HARTWELL, W. V. (1951). *Ibid.* **10.** 80.

YOUNG, G. A., & UNDERDAHL, N. R. (1951). *Arch. Biochem. & Biophys.* **32.** 449.

Mr. Hebeler said that he thanked the Chairman for his remarks at an earlier moment, and he wanted to say how bitterly disappointed he was at having to miss this of all Congresses. Also, he wanted to thank the very many people who had sent such very kind messages. They had touched his wife and himself very deeply. He then said:—

Having had the temerity to present a short paper with such a title as "Pig Diseases," I do not propose to attempt adding much flesh to what has become, for me, a beastly skeleton. It may be of value,

however, to add some general points which I gleaned during a recent visit to Denmark, a country which many regard at present as pre-eminent in matters porcine.

I was unable to obtain any general figure for pre-weaning loss but on one large farm, registered by the State for breeding and progeny testing, a figure of 15 per cent. was quoted with an average of 10 pigs weaned per litter. It seemed to me that there was some complacency about the average loss and this may be due to the high weaning number, but the attitude was surprising in view of the value of the stock on this particular farm.

With regard to puerperal fever I understand that the use of pituitary extract is regarded as an essential primary measure which is far more important than the exhibition of antibiotics; this would seem to imply that the condition is essentially a metritis.

Mastitis, as described in the paper, is recognised but the aetiology does not seem to be connected definitely with *Bacterium coli;* streptomycin and penicillin are used in treatment but apparently not serum. Similarly, only one type of agalactia is recognised, that due to failure of the "let down" mechanism and, when one injection of posterior pituitary hormone fails to have lasting effect, it is repeated at 12-hour intervals of three or four days.

Piglet anaemia is a well recognised condition but my impression was that it is not the cause of such significant losses as occur in this country; it may be that the Landrace sow, among other virtues, has the ability to secrete milk of higher iron content than other breeds! Many Danish breeders start creep feeding as early as 10 days, using skim milk at first and in this feed they add a small quantity of exsiccated ferrous sulphate; it would appear that this form of administration is both convenient and effective. Since the publication of this paper I have been the recipient of various preparations designed for easy administration to the piglet; while I am grateful for the opportunity of trying them and have no reason to doubt their effect, I remain of the opinion that the individual dosing of piglets on one or more occasions is not a desirable or very practical procedure.

I do not wish to add anything further but I hope to gain much useful knowledge from your discussion of these papers.

MR. HEBELER'S PAPER

The paper, which had been circulated previously, was as follows :—

THE development of all branches of the pig industry is greatly embarrassed by inadequate scientific knowledge and this is especially true when related to matters of pig health. In this limited contribution attention will be given to some diseases of the parturient sow and the causes of litter losses.

The Sow

Insufficient attention is paid to the management and feeding of sows and neglect is often responsible for the birth of weak piglets, and, in some instances, for failure to provide an adequate amount of milk. The pregnant sow should be provided with a grass run so that she can get sufficient exercise and have access to natural supplies of accessory food factors. An adequate supply of protein should be given during the last three or four weeks of pregnancy to assist mammary development and milk secretion. Sows, and especially gilts, should be given some time to settle in the farrowing quarters. Many losses can be traced to a failure to observe these elementary precautions.

Puerperal Fever is one of the commonest diseases affecting the parturient sow and it occurs irrespective of age. In large establishments it often affects a number of sows and appears to spread as an infectious disease. The location of the primary focus of infection remains uncertain. Although some cases show a little vaginal discharge, there are no definite signs of metritis and the fact that affected sows usually adopt a position of ventral recumbency and resist suckling may indicate that the infection originates in the mammary gland rather than the uterus. The disease readily responds to sulphonamides or antibiotic treatment and although the bacteriology of the condition requires confirmation, streptococci seem to be concerned in its etiology. On farms where the disease is troublesome the precaution is often taken of administering sulphonamides as a routine measure at farrowing.

Mastitis. The disease occurs under varying conditions, but badly insulated and damp cement floors seem to predispose to it and the incidence is highest in unduly fat sows. It is unfortunate that more information is not available regarding the organisms concerned with this condition in the sow. A study of a considerable number of cases in my practice which included a bacteriological examination of milk samples and *post-mortem* material, revealed that the disease is invariably associated with *Bacterium coli.*

One or more mammae may be affected and the severity of the symptoms varies. The disease usually appears immediately after farrowing, but its onset may be delayed for 48 hours, or even longer. In cases which occur relatively late after parturition *B. coli* and trauma by the piglets' teeth may be responsible. On premises where mastitis is prevalent prolonged labour is often an indication that the disease will appear.

In acute cases, the sow is very dull and cold with complete loss of appetite. The temperature seldom rises as high as 105° and this seems an important point in the early differential diagnosis from puerperal fever. Ventral recumbency is common and many animals have difficulty in rising; they stagger when moved about, and some become completely recumbent. In fatal cases the picture is, in fact, one of acute toxaemia, and severely affected sows become semi-comatose and may make wailing noises when disturbed. The affected mammae become grossly swollen, hot and painful, and in white pigs erythema of the skin of the affected mammae may be observed. The secretion is greyish in colour, but is often completely absent. Less acute cases do not show such severe systemic symptoms and the mammary lesion is more indurated in character. The milk secretion in all types of affected mammae

is permanently reduced or lost, and piglets on these teats will die unless removed and artificially reared. In most acute cases it is advisable to do this with the whole litter at an early stage, since even piglets on unaffected mammae may suffer from insufficiency of milk and may become fatally infected. In many cases of mastitis, especially the more acute ones, a moderate amount of slightly purulent uterine discharge may be observed; an investigation of a few such cases has revealed the presence of *B. coli* in this discharge.

In view of the nature of the causal organism so frequently found to be associated with this condition, the treatment adopted has been the subcutaneous injection of a stock *B. coli* serum at 48-hour intervals in doses of at least 20 c.c., together with streptomycin intramuscularly in one gm. doses daily for three days. The addition of penicillin may be helpful if sensitive organisms are thought to be present, or the differential diagnosis uncertain. Streptomycin treatment should not be continued for more than three days because of the possible toxicity of the drug. Intramammary infusion via the teat canal is not a practical treatment.

Agalactia simply implies a failure of the sow to produce milk. This may be caused by an attack of mastitis or puerperal fever, or some other severe systemic disturbance. There would appear to be three main types of agalactia :—

(1) This is due to a failure of the "let-down" mechanism. When it occurs the sow is quite normal in herself, feeds well and has no pyrexia, but she may resent suckling, probably because the frantic efforts of the piglets cause physical pain. The mammae are well developed and appear to be hard and congested, the nipples and the galactophorous sinus are slack and do not contain milk. Treatment consists of the injection of posterior pituitary hormone, either intravenously or intramuscularly. One such injection produces a very spectacular result, milk very soon appears in the teats and the sow and litter rapidly become settled and comfortable. The intramuscular route of administration is quite satisfactory though not so spectacular as the intravenous, but it does get over the often undesirable necessity, of securing the sow for the intravenous technique. I have not had an opportunity, as yet, of using the separated oxytocic principle of posterior pituitary hormone in this condition. It has been observed that the intramuscular insertion of a needle only will produce a reflex action, apparently similar to that of pituitrin, in a small number of sows.

(2) This appears to be due to a hormone disturbance affecting milk secretion; in this condition the sow is also quite normal and the piglets obtain some milk, although their appearance obviously indicates an insufficiency within 36 hours of birth. The mammae are reasonably well developed but are rather slack and do not appear congested with active milk production; the injection of pituitrin has no lasting effect, but the intramuscular injection of chorionic gonadotrophin in a dose of 500 I.U. frequently produces a lasting and satisfactory secretion.

(3) The third type of agalactia is due to failure of mammary development which may amount to an almost complete absence of secretory tissue. The condition may occur in sows which previously have farrowed normally, but is most frequently seen in gilts and has assumed some importance in view of its appearance in very high-priced animals whose value lies only in their breeding performance. Presumably the more severe cases are due to insufficient prolactin production by the anterior pituitary body. One might suspect that some hereditary factor plays a part here and, if so, there are obvious objections to breeding from such a strain of pigs. Faulty feeding and management can be traced as contributory factors in some cases of incomplete mammary development, a ration containing adequate protein of animal origin, sufficient exercise and preventing the animal becoming too fat all help to minimise a tendency towards this type of agalactia. It has been suggested that the massaging of the mammary area with stilboestrol in oil once daily for three weeks prior to parturition may help to encourage mammary development in some valuable sows, but it seems that there might be considerable risk of causing abortion, even so late in pregnancy.

In addition to these three types of agalactia suckling is prevented by inverted nipples. The condition causes pain and swelling and may simulate mastitis. It is easily diagnosed by examination of the nipples which are obviously undeveloped. There is no treatment and since the condition is stated to be hereditary in origin, care should be exercised in retaining stock for breeding from sows so affected.

The Piglet

Such information as is available indicates that the majority of losses occur during the first week of life. Over-laying is reported as the most important single cause of loss, but most piglets are ill before they are crushed and there is reason to believe the production of vigorous and healthy piglets would considerably reduce the losses attributed to this cause. The majority of losses undoubtedly result from factors which depress lactation in the sow or retard milk secretion immediately after farrowing.

An analysis of the mortality figures collected on several large and representative farms in my practice indicates that 20 per cent. of the piglets born alive die before they are weaned. While this result represents a very limited survey, the findings are very similar to those quoted by Tribe for other countries.

Although the diseases of the young pig have not been satisfactorily classified, experience indicates that some disorders which are troublesome in other species are not nearly so common in the pig. For instance, diarrhoea occurring as a primary condition during very early life is not a serious problem which is surprising in view of the fact that pathogens such as *Salmonella cholerae-suis* have a widespread distribution in the pig population. Similarly erysipelas is uncommon in suckling pigs. Joint-ill, however, does occur and a variety of infections may be responsible.

Hypoglycaemia (*Baby Pig Disease*). This highly fatal, sporadic disease affects pigs of from 24 to 72 hours old. The first symptoms of shivering, dullness and anorexia normally lead to coma and death within a period of about 30 hours. Pathogenic agents have never been implicated, but chemical examinations of the blood consistently reveal a low blood-sugar level (the normal range for pigs 12 to 48 hours old is 75 to 150 mg. per cent.; in cases of baby pig disease figures as low as 3 mg. per cent. have been recorded). Apparently, the disease may occur under any set of conditions, affecting the litters of both sows and gilts, large litters and small litters, with no apparent discrimination. The level of nutrition of the sow is apparently not of critical importance since the condition has been reported under ideal conditions of feeding.

It is perhaps significant that in many pigs dying from baby pig disease very little milk has been found in the stomach, which suggests that they had only suckled to a limited extent between the time of birth and the onset of symptoms. Experimentally a syndrome seemingly similar to the field condition has been produced by removing baby pigs from the sow and starving them for 48 to 72 hours. It has been suggested that the newly-born pig requires a period of several days for the mechanism involved in the control of the blood sugar level to function effectively. If this mechanism is not ready and the two common sources of blood sugar—absorption from the intestine and reserve glycogen stored in the liver—fail, irrespective of cause, to maintain a safe sugar level, a fatal hypoglycaemia becomes imminent.

Pig Anaemia remains one of the most important single causes of loss and of uneven litters, and many persistent cases of pneumonia, pleurisy and peritonitis occur in pigs which have been affected in early life. Unfortunately, the veterinarian is often not consulted regarding trouble experienced from this disease. Much of the loss could be corrected by the adoption of outdoor methods of rearing, but despite the studies which have elucidated the major factors concerned in the etiology of anaemia, there is still need for further information, especially regarding the methods by which iron can be conveniently administered to pigs.

Ascariasis is often exaggerated in importance in fattening pigs, but in young pigs insufficient attention is given to its significance. Not infrequently serious losses can be ascribed to *Ascaris lumbricoides* and in very young pigs the early age at which inactive worms are often found in the intestine indicates that massive infestations may occur during the first few days of life and damage to the liver may result from invasion by immature worms. Treatment with oil of chenopodium is the only safe method in such young pigs. The condition can be prevented satisfactorily by treatment of the sow prior to parturition on the lines of the McLean County Sanitation System practised in the U.S.A.

Virus Pneumonia is not a major cause of losses amongst piglets, it usually becomes apparent and leads to loss and unthriftiness after weaning. There is no satisfactory treatment, but it is important to prevent its spread by the adoption of a unit system for sows and litters. Coughing may be an indication of infestation with the lungworm *Metastrongylus apri*. Serious trouble, may in fact, result from this cause and the only precaution which can be taken is to use clean land for pig rearing.

Summary

While further knowledge is required concerning diseases of pigs, it is possible to recognise a number of diseases affecting sows and piglets. Therapy is successful in many instances and differential diagnosis is important. Pig mortality can often be reduced by good husbandry and the practitioner should apply his knowledge of management factors to problems of disease control.

THE OPENER'S SPEECH

The Chairman said that they were glad to have Professor Blakemore to open a very important discussion, and they all realised the great extent of his experiences in connection with porcine diseases and the rearing of pigs. A better choice of opener could not have been made.

Professor F. Blakemore (Bristol) said: I cannot help but feel that if this meeting had been held even 10 years ago the subjects chosen by the authors would have been very different. In that circumstance one could well imagine the papers being on swine fever, swine erysipelas and perhaps a multitude of other diseases the aetiology of which they did not understand. It is a sign of the times that the papers before us to-day are devoted to the management factors in relation to health problems as they are seen to-day, and touch on some of the more controversial aspects of pig management and pig losses.

The theme of the papers is the health of the sow and the rearing and health of the piglet. The present is a very good time for reviewing the position in relation to the pig industry, pig diseases and pig health in general.

During the war the pig population fell to a very low level but the farmer and small producer have now responded to the Government's policy of increased production, made possible by the availability of animal foodstuffs, by rapidly developing the industry to above the pre-war level.

Unfortunately, this revival has resulted in the output of too great a proportion of low-grade pigs, indicating that all is not well with our production methods. It has also provided further evidence that disease is a serious factor in the economy of pig farming.

Hebeler has stressed the need for a classification of the causes of litter losses and when we look at the vague classification of cases which the contributors have collected it is obvious that we have not yet got a clear conception of the factors which affect viability during early life. In fact, although one might instance a collection of the rare diseases, *e.g.* congenital myoclonia, iso-immunisation disease and leptospiral infection, all of which are important when they occur, it is impossible to present a clear account of the factors which cause the persistent mortality amongst piglets on the majority of farms.

There can be no doubt that husbandry methods have a direct effect upon the incidence of disease. Piglet anaemia presents one of the most striking examples. This disease made its appearance with the introduction of cement flooring and was known as "cement yard fever" until its real nature was appreciated. Virus pneumonia spreads and is perpetuated in the modern fattening shed, where large numbers of pigs are kept in a common atmosphere. Parasitic disease is another instance of how management systems may intensify a potential danger.

Unfortunately, it is not possible in this country to have a unified system of rearing pigs because there are significant climatic differences which have to be considered and the systems of farming upon which pig keeping is superimposed vary so much from district to district; as does the availability of different foodstuffs, such as milk

products, city swill and the grain of arable districts. Reviewing the position in relation to pig keeping in various parts of the world it is obvious that the pig in nature is a very adaptable animal, but we seem to be in need of much more information regarding its requirements when maintained under artificial conditions.

Basic Factors of Rearing

Reid, who has had years of experience of scientific pig rearing, has touched upon some of the important basic factors. We are in need of more information regarding the effect of environmental conditions on the health of pigs. The effect of cold and damp environment upon the health of young pigs was investigated by Naftalin & Howie (1949) and they produced evidence that such conditions produced liver disease explicable by the effect of prolonged exposure to excessive cooling on the hepatic circulation. It has been suggested that this condition may be mistaken for iron deficiency anaemia. We must await confirmation of these results, especially in view of the report by Lucas (1954). He records the result of an investigation into the effect on productivity of varying planes of nutrition on pigs maintained in good and bad houses at different seasons of the year. He was unable to detect any beneficial effects from the good piggery or from season in the case of pigs on a high plane of nutrition. But in the case of pigs on a low nutritional plane, the picture was entirely different and during the wintertime the pigs in the good piggery grew 44 per cent. fatter and 33 per cent. more effectively than those in the bad house.

In these experiments the well-known importance of a dry bed was amply confirmed. It is generally agreed that the sleeping quarters should be free from draughts and that the temperature of the fattening shed should not vary too much Chilling is regarded as a cause of losses in new-born pigs and the work of Newland *et al.* (1952) confirms that the body temperature regulating mechanism of the new-born pig is not fully developed, especially in litters below the normal weight. But the modern tendency to maintain pigs at a relatively high temperature by restricting air space and ventilation is to be deplored and it can only result in excessive humidity of the piggery and the spread of virus forms of pneumonia, which we must accept as universal in the population and impossible to prevent by any other means than management.

In England iron deficiency anaemia is still an important disease of piglets. The experiments described by Tribe are particularly interesting. Firstly, because they tend to show that the injection of iron preparations which are now usually used are not, in fact, of much value and secondly, because the evidence that has been produced indicates that recovery as indicated by growth rate can take place despite the deficiency when the pig has reached a certain age. This finding is in agreement with the trend of events in field outbreaks where persistent disease tends to be limited to the piglets which have suffered some permanent tissue damage during the anaemic period.

Oedema Disease

The contributors have confirmed that attention must be paid to diseases of the parturient sow and litter. As Hebeler indicates the agalactiae syndrome may include a number of clinical entities which must be separately identified and treated and it will be interesting to learn of the experience of other clinicians. He mentions puerperal fever, which in my experience may be troublesome on some farms and evidenced more by the birth of stillborn litters than serious disease in the sow. I should like to call attention to oedema disease. The typical disease is not difficult to diagnose but we have recently encountered cases which have presented an unusual picture. You know that in acute cases there is usually great distress and often inco-ordination, especially of the hindquarters, followed by death after a short illness. In the atypical disease the primary symptoms may not be severe but after apparent recovery a chronic phase follows, evidenced by loss of condition, diarrhoea, and signs of pneumonia. Pathologically, these cases would seem to be consequent upon the changes which take place in the oedematous areas, and I believe that we should regard oedema disease as a condition which can affect any tissue to a varying extent. The aetiology of the disease remains obscure but we have been able to confirm that it is characterised by a fall in the plasma protein.

Tribe has introduced the subject of nutrition as a factor influencing health. The technique of artificially rearing the piglet from birth opens up the possibility of making exact studies on the nutritional requirement of the pig and studying the pathology of deficiency conditions. It also provides a technique for investigating certain virus diseases and the effect of environmental influences with varying housing temperatures on the development of low-grade infections. An intensification of pig research is one of the surest ways of establishing a successful pig industry.

Lastly, how could veterinarians best play a part in the control of disease. When they dealt with a paper on poultry the previous day it became obvious that management factors were very intimately connected with disease and if the veterinarian was to play a part in keeping poultry health then a means must be found to allow him to take a much greater interest in poultry as such. So far they had not been able to provide the practising veterinarian with a proper approach to the poultry industry so that he could exert his full influence. The same was true of the pig industry in which so many diseases were intimately linked with management factors. Unless the veterinarian was placed in a position in which he could advise on nutrition and housing he was not likely to be able to contribute as substantially as he would like to the health of the pig and the prosperity of the pig industry.

References

LUCAS, I. A. M. (1954). *Farmer & Stock-Breeder.* **68.** 53.
NAFTALIN, J. M., & HOWIE, J. W. (1949). *J. Path. & Bact.* **61.** 319.
NEWLAND, H. W., MCMILLEN, W. N., & REINEKE, E. P. (1952). *J. Anim. Sci.* **11.** 118.

THE GENERAL DISCUSSION

Mr. J. T. Done (Weybridge) said that he wished to congratulate the three authors on the quality and content of their papers, and Professor Blakemore on an admirable summing up. Dr. Tribe's paper was at once interesting, stimulating and provocative, so much so that Mr. Done was provoked into taking him up on one or two points.

First, he did not like the implied sneer at any nutritional work which did not treat the piglet in the test tube manner beloved of the inductive research worker. Nutritional work on suckling pigs might not in the past have produced a great deal of accurate information, but the results were applicable to the suckling pig. The problem was not solved by working on the orphan pig; it was only altered, and the results so produced were primarily only applicable to the orphan pig under the precise conditions of the experiment. This point was made not in any carping spirit but lest by polite applause or by leaving unsaid what ought to be said they should help to perpetrate another heresy in the field of pig nutrition—a field which had already yielded a harvest of balderdash the like of which they hoped never to see again. Neither was this meant to disparage the efforts towards progress in the matter of the artificial rearing of piglets. They hoped soon to be provided with a cheap and easily prepared diet on which piglets could be raised from birth onwards with the minimum of fuss for all concerned.

Dr. Tribe had mentioned briefly two applications of artificial rearing of piglets: (1) the possibility of increasing the yield of piglets per sow per year and (2) the use of the baby pig as a laboratory animal. Although Dr. Tribe was primarily concerned with the use of piglets for nutrition experiments, the availability of young pigs independent of their dams from an early age would not only help to cut down the present high capital and maintenance cost of pigs used for all sorts of experimental work, but would open up fields of research that have been virtually impossible to tackle satisfactorily up to now. This led to a further point which Dr. Tribe did not mention but which might well have far-reaching effects. The ability to rear

successfully a high proportion of piglets removed aseptically from their dams at birth or even by caesarean section (Young & Underdahl, 1953), makes feasible the idea of raising stocks of pigs free from the obligate parasites of the species, viral, bacterial, protozoan and metazoan. These stocks would in time serve as nuclei for a new type of pedigree breeding with the accent on freedom from disease, as well as an absolutely invaluable source of pigs for experimental work of all kinds.

Turning to vitamin E, Adamstone, Krider & James (1949) had shown that piglets from sows kept on a vitamin E-deficient diet had muscular lesions similar to those found in calves and lambs. Dr. Tribe on the other hand had found that piglets up to weaning age were relatively resistant to vitamin E deprivation. Mr. Done said that he had found something similar. Over the last couple of years he had encountered a small number of cases of herztod (fatal syncope). The condition was found in adult pigs—pigs of five to six months of age and over—and was associated with a disturbance of nutrition and particularly with that part of the diet which was from animal sources. Blaxter & Brown (1952) in their review of vitamin E in the nutrition of farm animals had concluded that herztod as described in the continental literature might well be the result of a hypovitaminosis E. Under the heading of Heart Failure, Anthony (1950) had described similar clinical and *post-mortem* findings in pigs dying after transportation to the bacon factory. The lesions were apparently not pursued histologically but it might be valuable to do so and also to check on the diet.

Another condition (a nutritional encephalopathy) of adult pigs was probably part of the herztod syndrome as described by continental workers; the animals stuck their legs out firmly like a vaulting horse, had a dazed stupid look and were noticed by the pigman as they were not putting on weight. The condition cleared up on turning the pigs out to grass. Mr. Done said that in one case that he was able to follow up, a sample of the pig food was fed to experimental chicks. In 19 to 31 days all the chicks showed nervous signs and died or were killed *in extremis*. Encephalomalacic lesions were found in the chick brains.

Regarding Mr. Hebeler's paper, Mr. Done said that his own experience appeared to coincide with that of the Danish workers regarding mastitis. He obtained samples from affected udders, by needle biopsy. The difficulty of handling a sow being what it was he found it worth while to anaesthetise the sow with "Trilene." It enabled one to inspect the part in question in detail and to withdraw material for biological examination aseptically. The treatment he used was 3,500,000 units of penicillin inoculated into the affected gland in about six places. In many cases the sow would allow the piglets to suckle within 24 hours and it was difficult to distinguish which was the affected gland after 48 hours. Effective treatment was dependent on spotting the trouble early, but it was easy to do so as the sow refused milk to the piglets.

References

ADAMSTONE, F. B., KRIDER, V. L., & JAMES, M. F. (1949). *Ann. New York Acad. Sci.* **52.** 260–268.

ANTHONY, D. J. (1950). "Diseases of the Pig." 3rd edn. Baillière, Tindall & Cox, London. p. 198.

BLAXTER, K. L., & BROWN, F. (1952). *Nutr. Abstr. Rev.* **22.** 1–21.

YOUNG, E. A., & UNDERDAHL, N. R. (1953). *Amer. J. Vet. Res.* **14.** 571–574.

Dr. T. McNabb (N. Ireland) said it was with some hesitation that he spoke because he had so little to add to the excellent papers, but there were some problems which might be put to the essayists. The authors were to be congratulated upon their papers, as was the Provisional Committee for arranging for their presentation at a time which was most opportune.

If health in the pig industry was to be maintained and improved they must do everything they could to improve the type of pig which was put on to the market to find its way to the consumer. That called for an effort on the part of the breeder, the feeder, the scientist, the veterinarian and the curer.

Professor Blakemore had stressed sufficiently the need for education in those matters. We should equip ourselves with the necessary knowledge and put it across to the producer with all possible speed.

It was surprising that no mention was made in the papers with regard to the breed of pig and its relationship to feeding. Perhaps that was a controversial matter and would lead to trouble with breed societies. In Northern Ireland there was one main breed, that was of the large white York, and it made admirable bacon carcases. There were also a few Ulster type pigs which made good pork carcases but poor bacon carcases. They were comparatively of low financial value.

Mr. Reid mentioned in his paper that the average they should expect from a sow was 16 pigs per annum. That surprised Dr. McNabb. There were many farms in Northern Ireland producing far more than that number. It was a low estimate of the capabilities of the sow, which was equipped sufficiently to deal with far greater numbers. It was true that often at the time of service a sow took on commitments she was not able afterwards to fulfil. They should not permit to go into disuse those anatomical parts with which nature had provided the sow.

He would like to raise the question of split back fat, a condition seen in bacon carcases in which there was a separation of the fat along what had been described as the ante-natal line. It is most often seen in the lumbar region. It had been said that a genetic factor was involved, and also that certain feeding was a cause and that an injury predisposed an animal to the condition; but what was the condition, what was it due to and how could it be avoided?

The papers summed up in a very realistic way the conditions it was necessary to strive for in this industry. Pigs had to be bred along proper lines, fed correctly and kept free from disease, and then by the application of the basic principles of good husbandry it would be ensured that our animals grew to the full extent of their inherited capacity.

Miss Rosemary Welch (Rickmansworth) said that she was very interested in the papers; she wanted to stress the importance of the human element in rearing any animals and in individual care at farrowing, where great care was taken there were no losses of pigs other than of those born deformed, etc. Unsuitable mothers should not be kept but should go for sausage! As for pigs that were weaned very early, Miss Welch had seen very good results where they were fed on cows' milk, goats' milk and milk substitute, but if bottle feeding was going to be done she would like to know what was the best thing to use. Bottle feeding was very tedious and feeding with dry meal would be a welcome innovation.

She had hoped Mr. Hebeler would mention lymphatic leucosis in the sow. It did not occur very often but, when it did, it was very difficult to diagnose in the early stages. It could result in considerable expense for the owner. She had seen only one case in a newly farrowed sow, but it presented a tremendous problem and she had no idea what she was treating. The sow was eventually slaughtered, having lived much longer than one would think a really ill pig could live. For six weeks she fed almost entirely on goats' milk, her litter of nine was weaned very early and survived. The *post-mortem* revealed it was a case of lymphatic leucosis. Mr. Cotchin did the pathological work.

In capped hocks and capped knees the obvious factor was friction on the floor during suckling. Which floor was the most troublesome? She had seen smooth floors give more trouble than ordinary concrete, and although these blemishes were quite immaterial in the fattening pig they were very important in a pig to be sold for breeding.

Mr. J. L. McGirr (Weybridge), said he would like to ask a question on iron deficiency. Could any data be given on iron levels in liver, blood and excreta, and was there any evidence relating to the storage of iron in the young animal? It seemed that the part played by iron was straightforward if iron by mouth was effective and iron by injection was not. Was intake by the mouth affecting intestinal flora, or something else, which was producing other factors?

Mr. T. Barton Mann (Weyhill) congratulated the authors on their papers. The figure of 16 pigs per year was, in his opinion, quite reasonable. Seven or eight years previously he went to Illinois to examine the experimental work there in connection with the artificial rearing of baby pigs. At that time a protein from the soya bean was being used. He had had good success in rearing baby pigs from birth, and there was no need for the use of a bottle. Baby pigs could be taught from the first day to drink out of a pan.

Mr. Mann crossed swords with Mr. Hebeler on the question of baby pig disease. It was recorded as being hypoglycaemia. He was aware the Americans fed corn syrup where there was low blood sugar, but his work had not led him to believe it was primarily a hypoglycaemic condition because if the pigs were given a shock dose of about 90 mg. of riboflavin orally there was recovery in 24 hours, whereas with the glucose technique recovery was not obtained under about 48 hours. Also, pigs which recovered by the glucose technique oftentimes developed bone trouble at a later date. Was this to be put down to a dysfunction of the adrenal gland? Deduction did seem to show that baby pigs suffered in some cases from a delayed working of a gland and a hypoglycaemic condition resulted because of the delay. The bone troubles which developed after the recovery of the pig by glucose treatment took the form of lameness, usually in a hind leg. It seemed that the tibia would not support the increasing weight of the pig, this weight fell on the fibula, which bent, and the pig would stand with one leg lifted off the ground. X-ray studies indicated cartilage trouble and it was easy to visualise poor cartilage formation as a direct result of carbohydrate metabolism upset. He had never seen lameness result after the administration of riboflavin and indeed had cured lameness in pigs by riboflavin after glucose had got them over the immediate hypoglycaemic condition.

He wished some other name could be applied instead of Baby Pig Disease.

Dr. W. M. McKay (London) congratulated the authors and said he agreed thoroughly with Dr. Tribe on the necessity for care and attention for the young pig. One of the worst things that had ever come into the country was the "Danish" pighouse. If it were compared with the type of pighouse in Denmark it was seen to be quite unlike it. In this country it was usually a long, high-roofed, draughty place. The young pig was given little protection from the cold, though it had very little hair, no fur, no wool and no insulating layer of fat. A house of cold cement made it difficult for the proper temperature to be maintained and, as workers had shown, it was demonstrated conclusively in the prevention of piglet anaemia that good housing was one of the first essentials. If the pig was in an unprotected condition the circulation of the liver was impeded by the constriction of the chilled blood vessels and the appetite was affected; as a result the young pig did not take in enough food to maintain proper iron levels, and down it went with piglet anaemia.

As Mr. Mann had said, there was no need at all for bottle feeding of young pigs. If the little pig were coaxed and shown the meal it was not long before he was eating it. A young pig of about seven days, or of 5 lb. in weight, would take solid food very well indeed.

Dr. McKay said he wanted to ask the profession not to call pig oedema "protein poisoning." It was, in fact, unfortunate in the present state of our knowledge of the disease to blame the food for it. As far as the farmer was concerned trouble was never caused by anything he did himself, but always by something he had bought. For anything associated with indigestion in young pigs it was always the purchased feed; if mastitis, it was the milking machine.

Work was going on at the Rowett Institute and elsewhere on the question of increased litter size, and to Dr. McKay's mind the essence of it was the individual feeding of the sow. Sows should be given the opportunity of feeding themselves quietly and without squabbling and fighting and then the size of their litters would probably increase.

Mr. J. W. G. Leiper (Thurgarton) said that while Mr. Hebeler had pointed out that it was the young animal that suffered from ascariasis for which he recommended oil of chenopodium, this remedy was difficult to administer to pigs. Research work, however, was now in progress on the new anthelmintic Piperazines, which were both efficient and non-toxic and could readily be given by mixing with any type of food. Had Mr. Hebeler come across other worm parasites causing trouble? Lungworm did not, perhaps, come within the scope of the meeting because it occurred in older animals.

Mr. A. J. Wright (Macclesfield) thanked the authors and opener and said he was very impressed by Professor Blakemore's remarks on the feeding of the dam, the pregnant sow, which was probably one of the most important factors in successful pig rearing, coupled with good housing and warmth, and so on.

Since more food had become readily available to the dams there was, in his experience, more trouble with litters and more litter problems. On many pig farms some of the pregnant dams had become very fat animals, almost abnormal or pathological animals. There was an increase in so-called post-parturient fever. The sow farrowed down with plenty of milk, and within 48 hours the udder was hard and there was no milk. This disease had definitely been reduced by a cutting down of the rations of the breeding sow, at the time of service getting her into a more normal store condition and then feeding her up in the last month or six weeks of pregnancy and adding 5 per cent. of animal protein to the rations.

With regard to gut oedema, Mr. Wright thought they were all realising more and more that this condition was more prevalent and showing more sub-acute forms. There were many more cases within a greater range of ages of pigs. He had come across a lot more of the so-called trembling in pigs since there had been numerous outbreaks of swine fever. It was very remarkable that most of the trembling piglets that he had seen were on farms where swine fever was confirmed. Usually the sows that had given birth to those piglets had either shown very mild symptoms or no obvious clinical symptoms of swine fever, but in many cases the litters were of typical trembling pigs. One wondered if there was a neurotrophic type of swine fever. The pathological and histological lesions were almost identical with the neurotrophic lesion of the adult pig suffering from swine fever, the pathologists said.

There was no necessity for the expensive teats and foster-feeders. They were costly and time-consuming. It was quite easy to get piglets almost from birth to feed straight from shallow pans. He seemed to get the best results with the following mixture: Four pints of milk, one pint of water, two tablespoonfuls of sugar or glucose and one teaspoonful of cod liver oil. When efforts were first made to get piglets to eat out of a pan it was as well to keep them away from the sow or a short time while they were learning to drink.

Dr. W. A. Greig (Bucksburn) said that he congratulated the speakers and the Provisional Committee on the choice of a very good subject. While Dr. Tribe's method showed promise it was still in the experimental stages at Bristol and elsewhere, and it would be dangerous if the impression got around that it represented a panacea for raising pigs cheaply and well, and for cutting losses. Dr. Tribe had said that pre-weaning losses were reduced. Dr. Greig said it was difficult to see how there could be a tremendous difference because the heaviest losses in litters of pigs usually occurred within the first 24 or 48 hours of life. That was the vital time.

It was a little disappointing to hear that piglet anaemia was still so prevalent in England. It was a condition that could be controlled perfectly easily, iron by mouth being perfectly effective if given within the first few days of life. Iron by injection was a different matter and results might be most irregular. He had used one of the suspensions on the market in an attempt to attain a litter of pigs which were completely even in haemoglobin levels at weaning, but when identical quantities of iron were given by intramuscular injctions the result was a most uneven litter of pigs, far more uneven than a litter to which iron had been given by mouth.

Regarding the nature of self cure, it was no doubt simply a question of the availability of the iron in the suspension. A modern way of checking on body iron content was

to examine a bone marrow biopsy, and he had found that when iron in suspension was given intramuscularly to anaemic laboratory animals the iron content of the bone marrow was not materially increased at once. He had also found that if normal three-day-old piglets reared indoors without access to soil were given a small amount of suspended iron by injection they made poor progress for about four or five weeks, but that self-cure began at that stage rather than at weaning. They must aim at trying to find a substance which would release its iron easily when injected. A combination of iron and dextrin in solution promised to be much better than a suspension.

Mr. G. F. Kershaw (Newmarket) referred to previous remarks concerning the oral administration of iron. Some years ago he carried out some investigations into piglet anaemia to test the efficiency of certain iron preparations. The difficulty lies in giving iron preparations to young piglets in the first, second and third days of life when the elemental iron concentration is high.

In frequent cases there was considerable intestinal upset among these young piglets when these preparations were given, but if the iron content was reduced then a satisfactory rise in haemoglobin was not obtained. Ferrous gluconate is slowly replacing the oral administration of iron in the medical profession owing to its lack of irritation and rapid absorption in the gut. These points have also shown it to be of extreme value in the dosing of young piglets.

Mr. R. R. Willing (Exeter) said that it was refreshing to have this subject approached from an angle different from that to which those in the Ministry were accustomed. The future generation of veterinary officers would be very grateful for the research that was gonig on at the present time. He had made literally thousands of *post-mortems* too often without finding a clue as to what was wrong. Swine fever was still with them, though, because the tools were now available for dealing with it, it was of less importance. There was still a tendency to eliminate the other diseases before suspecting swine fever. It might be better to eliminate swine fever before the other diseases.

With regard to management generally, which seemed to be the theme of the discussion, some people thought that feeding fish meal to the extent of 10 per cent. was too much, while others thought it was too little. It would be useful to have the opinion of the authors on that point. The authors were to be congratulated on limiting the subject in the way they had.

Mr. R. Jobling (Hedon) said that he wanted to ask Mr. Hebeler to throw more light on the bacterial side. He had a feeling himself that the common germ affecting the pig was streptococci. There was a link, he felt, between venereal disease transmitted by the boar and early and late abortions in the sow, puerperal fever, and sudden deaths in litters when they were 24 hours old. If deaths were not experienced at that stage there was often a high percentage of acute arthritis in the suckling pigs.

Dr. N. S. Barron (Reading) said he agreed with the idea that they should make use of a trough and not bother about teats. In the rearing of piglets one factor was apt to be overlooked, and that was the risk of over-feeding. Many substitutes were apt to be a little strong, and the tendency of the user was to feed too much, and the result was scours, sometimes death.

With regard to hypoglycaemia in piglets, a number of veterinary investigation officers in this country and others had confirmed the American work showing that blood levels were in fact low in this rather troublesome disease, but there was quite clearly a secondary factor and they had yet to find out what was the cause. He was on the point of doing this when he moved and was unable to show whether the factor was a deficiency or an excess of something in the milk of sows which had produced affected litters. Nutritionists in general were unconvinced that any nutritional factor could affect a litter so adversely, but agreed there might be some "toxin" present. He was glad to see that emphasis was put upon hypoglycaemia. The subject was complex and complete ignorance persisted in regard to many of the early conditions that appeared in piglets. All the more praise therefore to Mr. Hebeler for having the courage to present his paper.

In connection with post-parturient fever, it was to be noted that it came at a time when the sow was in many cases on-teat. At that time the bactericidal effect of the uterus was variable, so it might be that an infection got through. But swabs from the uterus did not show any significant organism. Nevertheless, the fact that certain treatments were successful—*e.g.*, with sulphonilamide and penicillin and so forth—suggested an infection.

Anaemia had been mentioned, and Dr. Barron wondered if it really was so important and widespread as people believed. In his experience it was not so widespread. That might be because of the routine use of a vast number of remedies, but one could remember the days when they were not and the number of times when one saw clinical cases of anaemia in piglets was very small indeed. Perhaps the popularity of the remedies was caused because they brought about a mythical cure and were given to animals that never had anaemia and which never would be anaemic! Nevertheless, Dr. Tribe's slide, which showed the need for iron in those cases in which iron had been completely left out of the ration, was impressive. Presumably, under average conditions of management the piglet got just enough, and anaemia in the clinical stage did not appear.

Mrs. K. G. R. Kelly (Heswall) said that on numerous occasions recently she had had enquiries from pig breeders about rearing young pigs artificially in order to obtain three litters a year or more than two, and she was rather perturbed by the thought that perhaps this discussion would be published with the result that pig rearers would think that the profession agreed with the rearing of pigs artificially from birth. Mrs. Kelly could not agree too much with the statement that nature provided a very useful method for feeding the piglet. The further they got away from nature, the more likely they were to run into troubles. Loss of stamina was something to be thought of most particularly. When cattle breeders were dealing with bull calves for breeding purposes, they always kept the young animals on the cows for as long as possible, but often when calves were being bred for milk or kept for beef, they were taken off the cow after a few days, with resulting loss of stamina. Would piglets not lose antibodies if they were not reared on the sow?

Loss of baby pigs was often put down to over-laying by the sow. Recently Mrs. Kelly had been surprised to find how many baby pigs that were lost revealed an infection with *Bacterium coli*.

Mr. H. M. Wilson (Cupar, Fife) thanked the authors and the opener of the discussion and went on to say that Mrs. Kelly had made one of the strongest points that had been raised in referring to the incidence of *B. coli* in piglets from sows which had suffered with agalactiae. *B. coli* antiserum simply must be used.

The reference to iron was most perturbing. A short time ago they were told that little of it was absorbed when given by the mouth, and they were recommended to give iron in a soluble product by injection. Now they just did not know what to do, so would the scientists please help them?

REPLIES BY THE ESSAYISTS

Mr. Reid, in reply, said he had listened with great interest to all that had been said, and was glad in many ways that he had not got much to reply to. With regard to a much higher number than 16 piglets being reared per sow per annum in Ireland, he had said that they should set their sights at *not less* than 16. He was reminded of a visit he paid to Worcester where an elderly lady in the audience said she had a sow which produced about 40 pigs per annum. It farrowed 20 pigs twice in a year, and she took 10 away and reared them individually.

On the question of the Danish pighouse, some recent work done in Denmark seemed to suggest that even there the Danish house was not perfect. He believed a survey was made covering some 200 farms and marks were awarded for various points concerned with the buildings, such as the condition of the floors, walls, ceiling, insulation and ease of handling. The farms were then arranged in three groups, good, medium and poor, and various factors were related to the markings. One was food consumption, and it varied according to the house. It indicated that housing

had some effect on pigs, but it should not be thought that good housing alone was the cure for all the troubles in pig husbandry. Everything must be right before there were really good results.

Mr. Reid did not think they knew what constituted the ideal flooring. He would suggest the area should be dug out and there should be a 6-inch base of clinkers. These should be bound with ashes and partition blocks laid on concrete above them. On top of that should be put about 1 inch of concrete. He would not put 3 or 4 inches as was sometimes recommended. The flooring had given very satisfactory results.

With regard to publicity of rearing pigs on artificial food, he was reminded of the great publicity given to this in the United States, where it had been suggested that while the old sow could do the job of producing pigs better than the human operator, the human operator could rear pigs better than the sow!

Dr. Tribe, in reply, said that he was very sorry that he had left the impression with some of his audience that he had no high opinion of earlier nutritional work that had been done with young pigs. Of course this was not the case. It was actually the good work that had gone before that made possible the development of this new experimental technique. Just as there were some experiments that could not be carried out with a piglet suckling a sow in a sty, so there were many that could not be carried out with a baby pig fed a synthetic diet in a laboratory. The two approaches were, in fact, complementary.

Yes, iron analyses of various tissues had been carried out and in future work it was hoped to enlist the co-operation of a biochemist.

Time alone could prove if, under field conditions, pre-weaning losses would be lower under methods of artificial rearing than under sow rearing. The experiment referred to in the paper had been in progress for just over a year, about 200 piglets had been taken away from their dams, and the pre-weaning loss was about 14 per cent. That compared rather favourably with farm results obtained by the sow—and the sow had been doing this sort of thing for generations, not merely for one year! When more exact information concerning the requirements of the baby pig is available it may be possible to devise an improved formula for baby pig rations and so achieve better results than at present.

When synthetic " milk " diets were fed which contained a high percentage of fat one had to be very careful about over feeding. If there was over feeding the piglets scoured and lost weight. With the dry feed method, however, the piglets could be fed *ad lib.* with no danger of over feeding.

Dr. Tribe thought that all previous work on piglet anaemia showed that iron given by mouth was a satisfactory method both of prevention and cure. The best method of prevention was, however, to give the litter access to soil by keeping breeding stock out of doors.

Finally, a word or two should be added about the place of artificial rearing in livestock husbandry. It was a new development and it was primarily important as an experimental tool, but it did no harm to look into the future and to let the imagination wander. We must neither be against artificial rearing because it was new, nor for it because of its novelty. It seemed possible that in the future either by an appropriate breeding policy, or by a suitable injection of the sow at a suitable time, it might be possible to induce the production of very large litters, of perhaps 20 pigs per litter as a routine, and if that could be done two or three times a year it would enormously step up the production from each sow. In the meantime it was best to preserve an open mind on the subject.

Mr. Hebeler, in reply, said that he agreed that perhaps it was wise for practitioners not to express too many views on the subject of bowel oedema at the present moment. The subject of anaemia had been well dealt with by other speakers. He was grateful for Mr. Wilson's support of the *B. coli* theory but was sorry to notice that he referred to the condition as an agalactia, surely the primary condition was a mastitis and the agalactia purely secondary. Mr. Done suggested that the condition as described might well not be due to *B. coli* and enquired as to the method of obtaining material for diagnosis; massage and milking were usually able to produce a small amount of secretion on a sterile swab, especially in the early stages of the disease. In addition so many *post-mortem* specimens of mammary tissue, taken very soon after death, had revealed *B. coli* in pure culture that he felt reasonably confident as to this being the cause, especially as the treatment described appeared to be fairly specific. Mr. Done described his method of treatment of a disease he considered similar to that dealt with in the paper but he did not suggest the aetiology; since the penicillin therapy was so successful it must be presumed that a streptococcus must be concerned. Mr. Hebeler said that he had not had good results with this method of penicillin therapy in the condition he met and that an anaesthetic would certainly not be necessary as a toxic coma frequently made the patient relatively careless of handling.

He had not mentioned lymphatic leucosis because he had never been able to diagnose the condition and could not recall seeing a case that was suggestive of it. With regard to capped hocks, was Miss Welch referring to arthritis? If so, the condition in many adult pigs might be due to chronic erysipelas.

As regards hypoglycaemia, it might be suggested to Dr. Barron that his new sphere would give him an ample opportunity to broaden his knowledge of this and other pig diseases and perhaps they would have the pleasure of listening to a paper from him at some time in the future. Mr. Hebeler's contention was that hypoglycaemia was a secondary condition to starvation in piglets and that this starvation was frequently due to an insufficient secretion by the sow where the piglets were entirely dependent on her; he could not see anything in the American work on hypoglycaemia which contradicted this suggestion; in his experience the oral administration of glucose had a remarkable effect in temporarily strengthening piglets. The reference made to riboflavin was very interesting, but with his limited knowledge he was quite unable to connect it with the condition of hypoglycaemia; perhaps after the meeting someone would enlighten his ignorance.

He agreed with what had been said by Dr. McKay about Danish housing. The word " ventilation " was used too much in many publications; the animals did very much better in a smaller cubic air-space than was often recommended. With regard to a new anthelmintic, very young pigs with an infestation as described must be dosed individually; in his experience to date there was no easier or safer material than oil of chenopodium in castor oil. Metastrongylus infestation was important and he had experienced severe outbreaks of confirmed lungworm infestation in pigs from six weeks of age.

Mr. Wright connected cases of mastitis with over-feeding and no doubt it was correct to do so, but with the economic pressure which was beginning to bear on the pig farmer there might be a rapid return to pre-rationing conditions and consequently some of the sows would not be so fat in the future.

Finally Mr. Jobling suggested that streptococci were a very important bacterial parasite of pigs. Mr. Hebeler thought that was absolutely right and did not see how else one could explain the extraordinary success of the practitioner in the treatment of different diseases in pigs of all shapes and sizes since the advent of penicillin, and, of course, the consequent prosperity of the practitioner!

The Chairman said he was sure the meeting would wish to express its appreciation of the papers by the three essayists, Mr. Reid, Dr. Tribe and Mr. Hebeler, and of the contributions from the meeting generally. The vote of thanks was carried with applause.

NEW LECTURER AT CAMBRIDGE

We learn that Mr. A. A. Wilson, M.V.SC. (Liverpool), M.R.C.V.S., has been appointed to a Lecturership in the Department of Animal Pathology, University of Cambridge. He takes over his duties on January 1st, 1955. Mr. Wilson is at present a member of the Veterinary Science Division, Research Department, of Messrs. Boots Pure Drug Co. Ltd.

TWELFTH CONGRESS PAPER

Neoplasia in the Dog

BY

E. COTCHIN

Department of Pathology, Royal Veterinary College, London

This paper was discussed at the Torquay Congress on the morning of September 24th. The chairman was Professor W. L. Weipers, and the recording secretary Mr. R. S. Townson.

THE Chairman said that this was a subject of very wide interest and apart from its importance to clinicians in veterinary practice it had a wide application to the whole question of neoplasia and the cancer problem.

Mr. Cotchin introduced the paper by showing some slides which brought out its main points, and in particular some radiographs of bone sarcomas.

THE PAPER

Mr. Cotchin's paper, which had been circulated previously, was as follows :—

NEOPLASMS occur commonly in dogs although their exact incidence is not known. Knight and Douglas (1943) suggested that some 5 per cent. of the dogs examined at the Beaumont Animals' Hospital would show neoplasms clinically and surveys at Colleges and clinics abroad have given similar results. For dogs autopsied, the incidence has occasionally been put at 10 per cent. or higher. Even without histological confirmation, an estimate of the incidence of neoplasia in dogs would make an interesting study for the general practitioner and might, for example, reveal geographical variations of frequency such as have been found for certain human neoplasms. A veterinary surgeon in North London has kindly kept records of this kind for me, and estimates that 15 per cent. of the dogs seen are affected with some kind of neoplasm.

The surveys (Cotchin, 1951, 1954 a and b) on which the Tables in this short paper are based comprised a total of 2,361 neoplasms examined in the Royal Veterinary College Pathology Department—1,211 in 1940-1949, and 1,150 (the "1150" series) in 1950-1953. These various Tables, put in to provide a basis for discussion, should not be interpreted rigidly—a short way of conveying information, they may conceal quite as much as they reveal.

Age Incidence and Distribution

The incidence of tumours becomes generally greater as the dog gets older. The ages of 1,018 tumour-bearing dogs (from our "1150" series) are shown in Table I, and there are shown for comparison the ages of what may be called "clinic cases"—actually of 2,500 dogs examined in the Beaumont Animals' Hospital (these comprise the first 625 dogs examined clinically for any cause at all (including neoplasia) in each quarter of 1950).

Since by no means all the neoplasms examined came through the Beaumont Hospital, it is not possible to give the definite age distribution of the population of dogs from which they were taken, but this rough comparison may be interesting. The average age for the tumour-bearing dogs was eight years, whereas for the clinic cases it was 3½ years. The incidence of tumours rose sharply up to the sixth year of age and remained high up to the 10th, and even to the 13th, year. Fifty per cent. of the tumour-bearing dogs fell into the 6-10 years of age group; 25 per cent. were under five years of age; and 25 per cent. were over 10 years of age. Of the clinic cases 50 per cent. fell into the 1-5 years age group; 27 per cent. were under one year of age, and 5 per cent. were over ten years of age. This persistence of relatively large numbers of cases into the advanced age group supports the opinion that, allowing for the decreasing number of ageing dogs,

Table I

AGE DISTRIBUTION OF TUMOUR-BEARING DOGS, COMPARED WITH CLINIC CASES

Age	1,018 Tumour-bearing dogs Per cent.	2,500 Clinic cases Per cent.
Under 1 year	1·47 (15)†	27·20 (680)†
1 to 5 years	23·98 (244)†	50·56 (1264)†
	1 year ... 1·77	1 year ... 13·60
	2 ,, ... 3·54	2 ,, ... 11·76
	3 ,, ... 4·52	3 ,, ... 10·64
	4 ,, ... 5·80	4 ,, ... 8·00
	5 ,, ... 8·35	5 ,, ... 6·56
6 to 10 years	50·20 (511)†	17·04 (426)†
	6 year ... 10·02	6 year ... 4·08
	7 ,, ... 9·82	7 ,, ... 3·28
	8 ,, ... 12·18	8 ,, ... 4·20
	9 ,, ... 8·06	9 ,, ... 2·56
	10 ,, ... 10·12	10 ,, ... 2·92
11 to 15 years	23·78 (242)†	5·20 (130)†
	11 years ... 6·78	11 years ... 2·44
	12 ,, ... 8·45	12 ,, ... 1·68
	13 ,, ... 5·60	13 ,, ... 0·52
	14 ,, ... 2·16	14 ,, ... 0·28
	15 ,, ... 0·79	15 ,, ... 0·28
Over 15 years	0·59 (6)†	0·00
	16 years ... 0·39	16 years ... 0·00
	17 ,, ... 0·20	17 ,, ... 0·00

† = the numbers in brackets are the actual number of dogs.

the actual incidence of tumours is itself increasing. Rather similar figures are given by Mulligan (1949, p. 2) for a series of 809 tumour-bearing dogs.

Breed Incidence

The various common breeds (including for the nonce mongrels as a breed) are well represented in the list of tumour-bearing animals.

Table II

COMMONEST BREED INCIDENCE OF TUMOURS IN DOGS, AND A COMPARISON WITH CLINIC CASES

Breed	Total number of tumours	Per cent. (of 1,037 tumours)	Per cent. of breed in 2,500 clinic cases
Mongrels and cross-breds	286	27·58	40·32
Spaniels	156	15·04	14·00
Scottish Terrier	102	9·84	3·48
Retriever	61	5·88	1·84
Alsatian	50	4·82	6·84
Fox Terrier	50	4·82	7·76
		67·98	74·24

The breeds which contributed 50 or more tumours in the series of 1,150 tumours (the breed of only 1,037 dogs being known) were mongrels (including cross-breds), Spaniels, Scottish Terriers, Retrievers, Alsatians and Fox Terriers; these totalled 68 per cent. of the dogs whose breed was known—in the corresponding series of 2,500 clinic cases they formed 74 per cent. A further 14 breeds (unspecified Terrier, Boxer, Bull Terrier, Poodle, Collie, Airedale, Cairn, Dachshund, Great Dane, Sealyham, Corgi, Setter, Greyhound, Bulldog) contributed from 10 to 50 tumours and formed 25 (24.59) per cent. of the dogs whose breed was known; in the contrasted series of 2,500 they formed 16 (15.68) per cent. A further 26 breeds contributed less than 10 tumours each.

Sex Incidence

Table III shows the sex incidence of 1,001 tumours from the dogs in our "1150" series for which the sex was known, and for comparison it may be said that in the contrasted series of 2,500 dogs there were 1,486 males (59 per cent.) and 1,014 females (41 per cent.).

Table III

SEX INCIDENCE OF TUMOURS FROM DOGS

		Total	Per cent.
Total Male		508	51
Male Genital System	77		
Other systems	431		
Total Female		493	49
Female Genital System	266		
Other systems	227		
		1,001	

Site Incidence

Neoplasia has different manifestations in different species, each having what might be termed its own characteristic "spectrum" of spontaneous tumours. For example, Willis (1948, p. 71) gives a table showing his findings in a series of 943 consecutive autopsies on human cancer cases; of these, cancer of the stomach and large intestine together accounted for 300 (31.8 per cent.), cancer of the lung for 71 (7.5 per cent.), and cancer of the uterus for 25 (2.7 per cent.)—these are all rare sites of cancer formation in the dog.

Taking the total of 2,361 tumours (that is, combining the series of 1,211 and 1,150 tumours) their distribution in the various body systems is as shown in Table IV.

Table IV

SYSTEM OF ORIGIN OF NEOPLASMS FROM DOGS

System	Total	Per cent.
Cutaneous	932	39
Female genital	535	23
Alimentary	364	16
Male genital	160	7
Skeletal	105	4
Lymphatic	88	4
Miscellaneous	177	7
	2,361	100

Over three-quarters of the tumours that were received for examination were in one or other of three systems—cutaneous, female genital and alimentary—while most of the rest were in the male genital, skeletal and lymphatic systems. It is proposed to comment on the more interesting and important tumours in these various systems.

A. Cutaneous system

A classification of the 932 tumours is shown in Table V.

Table V

CLASSIFICATION OF CUTANEOUS NEOPLASMS OF DOGS

		Total	Per cent
Connective tissue origin		374	40
Sarcomas and sarcoma-like proliferations	208		
Fibroma	88		
Lipoma	33		
Mast cell lesions	23		
Angioma	22		
Epithelial origin		276	30
Basal-cell and glandular (including hepatoid)	94		
	210		
Squamous carcinoma	48		
Papilloma	12		
Epidermal cyst	6		
Melanoma		164	18
Miscellaneous and undiagnosed		118	13
		932	101

The tumours of this system form a complex group from the point of view of diagnosis and prognosis; for example, a large number of tumours look like sarcomas histologically, but many of them do not behave like sarcomas clinically. An interesting and valuable account of 709 skin tumours in dogs is given by Head (1953). A close study of these "sarcomas" is called for. Mast cell lesions have been seen in a moderate number of dogs—Riley and West (1953) have demonstrated a high histamine content in two such growths.

One of the commonest types of skin tumour is the tumour of melanin-producing cells, or melanoma. We have found it useful to divide melanotic tumours of the dog's skin provisionally into three groups, based on their macroscopic, histological and clinical

features—the malignant melanoma, the benign cellular melanoma, and the benign fibrous melanoma. The breed most often affected with skin melanomas was the Scottish Terrier (25/81), which predominated over the mongrel (21/81), and was over twice as often affected as any other breed. Favoured sites of origin were the digits (61/164)—except for the fibrous type—and the scrotum (14/164). Definite multiple lesions were present in a fair but unrecorded proportion of cases. Males were more often affected than females.

The malignant melanomas appeared to develop in the deeper parts of the cutis, and to grow both deeply into the underlying tissue, and out towards the surface, usually with ulceration. They were usually larger than the benign tumours but sometimes had a misleadingly well-defined edge macroscopically. The degree of pigmentation was generally heavy. Metastases were also usually, but not always, heavily pigmented. When metastasis did occur in most cases the regional lymph node was affected, as well as the lungs, but there was a great tendency for extremely widespread secondary deposits to be found. The malignant type merged with the next, the benign cellular melanoma, which showed a marked predilection to grow in the region of the digits. This type of tumour also appeared to develop in the deeper layers of the dermis and grow outwards between neighbouring groups of hair follicles, bulging the skin upwards, sometimes with ulceration, to form jet-black, rather dome-shaped structures, which tended to lie rather flatly on the skin surface, with a fair amount of tumour tissue submerged below the general skin level. The third type, the benign fibrous, appeared as variably (often only patchily or slightly) pigmented, obviously fibrous tumours, growing up from the deeper level of the dermis, displacing hair follicles, bulging the skin upwards and sometimes ulcerating. They were often rather pedunculated, warty growths.

The first two types appear to correspond with Mulligan's "cancerous" and "non-cancerous" types; the third type corresponds to some extent with his " spottily-pigmented neurofibromas " and strongly resembles lesions described by Spurrell (1932), which he considered to be neurofibromas which became secondarily pigmented by a "sinking in" of pigment-cells from the overlying epithelium.

The melanomas of the skin of the dog appear to be more often benign than malignant (for oral melanomas the converse holds). A study of their early stages is needed; there are sometimes suggestions of a nervous origin, which is interesting having regard to the theories of their histogenesis in man. What would be of particular interest to know would be whether, in the dog, some of the malignant tumours develop from benign melanomas, and if so, under what circumstances—irritation, incomplete excision, and so on.

B. Female genital system

The common vaginal lesion is one of proliferation of fibrous or smooth muscular tissue, in varying proportions, usually in an ill-defined polypoid mass with a structure that suggests hyperplasia rather than true neoplasia. Some of the ovarian tumours were "granulosa cell tumours" and had oestrogenic effects, being accompanied, for example, by endometrial hyperplasia and "pyometra."

Table VI

SITE OF ORIGIN OF TUMOURS OF THE FEMALE GENITAL SYSTEM OF DOGS

	Total	Per cent.
Mammary gland	431	81
Vagina and vulva	70	13
Ovary and mesovarium	25	5
Uterus and cervix	9	2
	535	

The commonest and most important tumours in the female genital system are, of course, those of the mammary gland. Eight out of ten tumours of the female genitalia in our series were in the mammary gland. A number of problems are still unsolved with regard to these mammary tumours, *e.g.*,

(i) What are the histological criteria of malignancy? In our series, only 8 per cent. (36/431) were definitely known to be malignant in that metastases were demonstrated, whereas usual histological criteria would place the proportion higher than this. More follow-up histories are needed.

(ii) How is the remarkable structure of some of these mammary tumours to be accounted for? The bone that may be present seems to be related to the presence of cartilage, and the latter to the presence of myxomatous tissue, which has been traced to changes either in the connective tissue in the tumour, or even to the activity of the epithelium, and it may be that here we are dealing with an abnormal expression of the normal softening that takes place during lobular glandular proliferation prior to lactation. That the cartilage and bone, whatever their origin, are in some cases at any rate truly neoplastic is shown by the occasional occurrence of metastasising chondrosarcomas or osteosarcomas of the mammary gland.

(iii) How many of the mammary lesions are true neoplasms, and how many would fall into the group of "mammary dysplasia" (see Anderson, 1948, p. 1178) or "fibroadenocystic adenopathy" (Mulligan, 1949, p. 3), where the changes, of hormonal origin, are neither inflammatory nor neoplastic in type?

(iv) Since neoplastic tissue seems in some cases to develop in dysplastic tissue, what is the cause of this mammary dysplasia? It is generally held that the mammary tumours of the bitch, while they can and do occur in animals that have bred normally, and had normal oestral cycles, are more often seen in ageing bitches that have not bred for some time if at all, or in animals that have shown irregular and abnormal heats, or in animals that have often shown marked pseudo-pregnant lactations, or have failed to suckle their litters fully. They are often (Mulligan, 1949, p. 18) associated with follicular ovarian cysts, persistent corpora lutea, cystic hyperplasia of the endometrium and "pyometra." It has been thought that there might in these circumstances be

an accumulation of secretion in the mammary glands, and that this retained material itself would cause proliferative changes in the glandular tissue. It has been shown, for example, that the incidence of mammary tumours in mice can be increased by sealing the teats, or by preventing suckling and thus causing milk retention. Apart from an experimental approach to the problem, it would be of interest to collect as careful details as possible of the heat and breeding histories of bitches in which mammary tumours have developed. It is perhaps unlikely that anything of the "milk factor" kind is concerned in the formation of these tumours. It would also be of interest to know whether ovariectomy or adrenalectomy have been tested therapeutically.

C. Alimentary system

Of every ten tumours of the alimentary system, roughly six were in the mouth, two in the intestines, one in the liver, and the rest elsewhere. There was a paucity of carcinomas of the large intestine and, particularly, of the stomach: cancer of these sites is common in man. Over a third of the tumours from the oral cavity were carcinomas of the tonsil —the commonest specific carcinoma we have seen in London—it appears to have been rare in Mulligan's part of America (Colorado). This tumour, which may appear papilliform, or form a crater-like ulcer, has no particular sex or breed or age incidence. It tends to metastasise to local lymph nodes early in its clinical course, and does so in the majority of cases. The lymph nodal metastases are usually but not always on the same side as the primary tumour, and affect most often the superior cervical node, and a little less often the mandibular node. The prescapular nodes and the lungs may be involved, the latter in about a quarter of the cases. It might be suggested that this tumour is due to some ingested carcinogenic agent acting on a susceptible tissue and the dog's tonsil would be an accessible site for an experimental test of this hypothesis.

Table VII

SITE OF ORIGIN OF TUMOURS OF THE ALIMENTARY SYSTEM OF DOGS

	Total	Per cent.
Mouth (including 85 of the tonsil)	224	62
Intestines	83	23
Liver	38	10
Pancreas (12), Stomach (5), Salivary gland (1), Oesophagus (1)	19	5
	364	100

Apart from the tonsillar carcinoma, the other important malignant tumour of the alimentary tract is the intestinal lymphosarcoma. The lesions may be quite diffuse in the wall of the intestine but are usually more localised and tend to occur as one or more diverticulate structures, with thickened greyish walls, along the course of the gut, to which the omentum is adherent. The small intestine is involved more often than the large, and the mesenteric node is affected in at least half the cases, and spread may occur to still other abdominal nodes. The prognosis regarding operative removal is bad, as the impression from some specimens is that even where neoplasia has not yet occurred, some of the rest of the intestinal lymphoid tissue is becoming involved. The suggestion that this intestinal lymphosarcoma, too, is due to some ingested carcinogen could be tested experimentally.

D. Male genital system

Testicular tumours are common in dogs, prostatic tumours are rare. Corresponding to the three important types of cells in the testis—the Sertoli cell, the spermatogonia, and the interstitial cell—there are three chief types of tumour—the Sertoli cell tumour, the seminoma and the interstitial cell tumour. The first of these, which from its structure is sometimes known as a tubular adenoma (a usefully non-committal term), forms about half the testis tumours and is nearly always benign. At least half of the tumours of this kind in our "1150" series were in testes that were not in their proper scrotal position, and one in three of the affected animals showed a feminising syndrome or alopecia, their symptoms disappearing quickly after removal of the tumour. Seminomas appear to be of low malignancy, only occasionally producing metastases. They generally develop in testes in their normal scrotal position and are not usually accompanied by any hormonal disturbance. The interstitial cell tumour, which is much less common than the other two (assuming that the small lesions of proliferation of interstitial cells commonly seen in the testes of ageing dogs are nodules of hyperplasia and not truly neoplastic), is fairly easily recognised by its orange-brown colour on the cut surface, due to the lipoid present. Malignancy of this tumour also appears to be low.

Table VIII

CLASSIFICATION OF TUMOURS OF THE MALE GENITAL SYSTEM OF DOGS

		Total	Per cent.
Testis		136	85
Tubular adenoma	67		
Seminoma	47		
Combined forms	2		
Interstitial-cell	14		
Others	6		
Prostate		14	9
Adenoma	7		
Carcinoma	7		
Penis		9	6
Transmissible venereal tumour	8		
Angioma	1		
Spermatic cord		1	
		160	100

The transmissible venereal tumour ("venereal sarcoma," "venereal granuloma") seems to occur much less commonly in London dogs nowadays than formerly. It seems to be very sensitive to X-ray therapy.

E. Skeletal system

Table IX

SITE OF ORIGIN OF NEOPLASMS OF THE SKELETAL SYSTEM OF DOGS

Bones		97
Humerus	18	
Ribs	17	
Radius	13	
Tibia	12	
Femur	11	
Others	26	
Tendon sheaths and muscles		8
		105

Nearly all the tumours of the skeletal system of the dog affect the bones and nearly all of them are malignant (Cotchin, 1953). The common sites are the upper part of the humerus, the middle-numbered ribs (arising just above the costo-chondral junction) and the lower part of the radius, femur or tibia. The limb bone tumours practically always occur in large breeds of dog. In perhaps half the cases they metastasise early in the clinical course of the disease, chiefly by way of the blood stream: a palpably enlarged local lymph node is more likely to be showing haemosiderosis than neoplastic involvement. A notable feature of some limb-bone tumours is the marked production of non-neoplastic periosteal new bone. The rib tumours occur particularly in dogs of about two to four years of age.

The possible relationship of these bone tumours to trauma, or to osteodystrophic conditions such as rickets or osteoporosis, needs study and the dog seems a likely animal for the experimental study of bone sarcomas.

F. Lymphatic system

The only remaining common malignant tumour is the lymphosarcoma, occurring usually in its generalised form as lymphatic leukosis. This condition, sometimes rather misleadingly known as pseudo-Hodgkin's disease, occurs in dogs of all ages, with a slight tendency to affect the rather younger dog. The breed most often affected in our "1150" series was the Scottish Terrier. The main symptom is of a more or less bilaterally symmetrical and generalised enlargement of lymph nodes, which is sometimes first obvious in the neck region. Anaemia occurs, but most cases do not show any great increase in the lymphocytes in the blood, so that the surest way of confirming a diagnosis is not by examination of blood but by histological examination of a lymph node removed at biopsy. The disease behaves like a malignant neoplasm and is so far as I know not permanently curable. In view of the importance of leukosis in man, a close comparison of the dog condition with human lymphatic leukosis is indicated, and then experimental studies might be started.

Other interesting tumours occasionally seen include carcinomas of the thyroid, kidney or urinary bladder. Noteworthy is the rarity of primary lung carcinomas and of primary or secondary brain tumours.

Discussion

Age incidence

To what may the age incidence of tumours, illustrated by Table I, be due? Perhaps the following factors are important:

(i) A long latent period of development following exposure to extrinsic (*e.g.*, contaminated atmosphere in towns) or intrinsic (*e.g.*, hormonal unbalance) factors. Mulligan (1949, p. 2) suggests that the average induction period of cancer in the dog might be about two years.

(ii) An increasing exposure to such tumour-producing factors in older dogs.

(iii) An increasing chance of exposure to secondary or "releasing" factors—it has been shown that agents that are themselves not carcinogenic (*e.g.*, croton oil) may elicit tumours in tissues previously exposed to carcinogenic agents (*e.g.*, tar) when the latter have been experimentally applied in doses insufficient in themselves to produce cancer.

(iv) An increasing susceptibility of ageing tissue to undergo neoplastic change in response to factors which would be insufficient to cause tumour-formation in younger tissues.

The surprising and baffling fact is, perhaps, not that a number of dogs do develop tumours as they grow older but that a number (possibly much larger) do not!

However, not all tumours of dogs occur in the older animal. For example, thymus tumours are usually restricted to young dogs, and sarcomas of bone, and in particular of ribs, are seen predominantly in quite young dogs; lymphosarcomas, too, seem to be rather more prone to develop in younger dogs.

Breed incidence

There are indications in the dog of special breed incidence of tumours, *e.g.*, sarcomas of limb bones tend to occur in large animals, such as the Great Dane, and melanomas and perhaps lymphosarcomas tend to occur rather frequently in Scottish Terriers—a similar observation is made by Mulligan (p. 6), who also comments that "the Boston Terrier, a breed definitely on its way to extinction, has a strikingly high incidence of mast cell sarcoma," while "the tendency for breeds with a bull strain, such as Boston Terrier, Bulldog, and Bull Terriers to be affected [with brain tumours] is noteworthy" (p. 114). The breeds of dog may in some degree correspond with the various strains that have been developed in mice to show certain types of tumour in abnormally high incidence. The opposite condition of "negative susceptibility" of certain breeds to tumours that are common in other breeds may well exist, and should be looked for. For example, in our series the Scottish Terrier and Retriever were perhaps unexpectedly high in the list of tumour-bearers and the Pekingese and Chow were unexpectedly low.

Sex incidence

Apart from the special sex organs, it does seem in general that sex may sometimes play a part in the incidence of neoplasms. For example, in man, cancer of the alimentary tract is commoner in males;

skin cancer of the Angora goat affected females most often, castrated males rarely, and entire males never; the majority of cat tumours occur in castrated males (which may of course themselves be in a majority). In the dog, skin glandular tumours, and particularly those of the circumanal and similar glands, are most often seen in males. This problem could be explored in practice and, as with stilboestrol and circumanal adenomas, might suggest a non-surgical adjunct to therapy.

Malignancy

The commonest and most important malignant tumours of the dog we have encountered were: sarcomas and carcinomas of the skin, melanomas of the skin and mouth, carcinomas and other malignant tumours of the mammary gland and, in particular, the four following tumours—carcinoma of the tonsil, lymphosarcoma of the intestine, sarcoma of bone, and lymphatic leukosis. It is of interest to compare this list of malignant tumours in dogs with those found most commonly in a series of 226 tumours from cats (Cotchin, 1952)—carcinoma of the oesophagus and of the tongue, carcinoma of the mammary gland, osteosarcoma of the humerus, lymphosarcoma of the intestine and sarcoma of the mesenteric node.

Value of study of neoplasms of the dog and other domestic animals

The study of tumours generally in the domestic animals is of great interest, and I would suggest that a closer and really extensive study of neoplasms in these animals in general, and in the dog in particular, would be well worth making for the following reasons:

(i) To provide a more exact basis for diagnosis and prognosis. This is the immediate importance of their study. From this immediate practical viewpoint, the clinician can help by supplying certain minimal information about his cases when submitting material: reference name or number of the case; age, breed and sex of affected animal; site of neoplasm; clinical features (when first noted, rate of growth, present appearance, condition of local lymph node, radiographic findings locally and in lungs if known, general clinical condition); clinical diagnosis; clinical prognosis.

(ii) It cannot be too strongly urged that the study of spontaneous tumours in animals is in any event justified if it will throw any light at all on the general problem of cancer in man, in whom it is fast becoming the most common killing disease. Close collaboration between clinician and laboratory in such a study is essential and there is no doubt that we should very seriously consider the possibility of setting up a Registry of animal neoplasms. As was pointed out previously, this Registry would be concerned with tumours from large as well as from small domestic animals. Here, standards of histological classification would be set up and clinical and pathological features of the different cases recorded, with post-operative histories, post-mortem records, actual specimens, histological and radiographic material, photographs, and so forth. The Registry would be open to all workers interested and could gradually build up a large amount of very valuable comparative material.

(iii) Very little is known yet about the geographical distribution of cancer in the dog. There is some suggestion that carcinoma of the tonsil is particularly prevalent in the London area and it also appears that carcinoma of the thyroid is common in regions where goitre is commonly seen in the dog. Studies of larger numbers of tumours from different parts of the world may reveal other differences, which may suggest possible ætiological environmental factors that could be brought under experimental study.

(iv) The spontaneous tumours of the dog are often quite large and could provide ample material for such studies as chemical analysis, histochemical tests, and so on. Transplantation studies have been undertaken and could be extended.

(v) The dog, which lies between man and the small laboratory animals in size, might be used for therapeutic trials, with the great experimental advantage that it could be killed at any selected stage of the trial. Immunological or other biological work could be done too. If the general public knew that such trials were contemplated, they would surely feel able to permit their affected pets to be used experimentally in a humane way.

(vi) Any theories as to the origin of cancer in man must, broadly speaking, be capable of application in other species, and, conversely, any ideas as to the cause of cancer in dogs, and capable of experimental proof, might be applied with due caution to man.

Much more use should be made of the large reservoir of spontaneous tumours in dogs, and our discussion will have served at least one good purpose if it does no more than again draw the attention of cancer research workers to some of the problems posed, and opportunities provided, by the study of neoplasia in the dog.

Summary

An account is given of some common and important neoplasms of dogs, based on a survey of the 2,361 tumours that were examined in the Department of Pathology, Royal Veterinary College, London, in 1940-1953. Tables show some aspects of the age, breed, sex, and system incidence of the tumours, and particular mention is made of common and important malignant tumours, including melanomas of the skin, mammary cancer, carcinoma of the tonsil, intestinal lymphosarcoma, sarcomas of bone and lymphatic leukosis (pseudo-Hodgkin's disease). Ways in which the study of animal tumours might be intensified from the practical and academic viewpoints are suggested.

References

ANDERSON, W. A. D. (1949). "*Pathology.*" London. Henry Kimpton.

COTCHIN, E. (1951). *Vet. Rec.* **63.** 67; (1952). *Proc. roy. Soc. Med.* **45.** 471; (1953). *Brit. vet. J.* **109.** 248; (1954a). *Ibid.* **110.** 218; (1954b). *Ibid.* **110.** 274.

HEAD, K. W. (1953). *Vet. Rec.* **65.** 926.

KNIGHT, G. C. & DOUGLAS, S. W. (1943). *Ibid.* **55.** 195.

MULLIGAN, R. M. (1949). "Neoplasms of the dog." Baltimore. Williams and Wilkins Co.
RILEY, J. F., & WEST, G. B. (1953). *J. Physiol.* **120.** 528.
SPURRELL, W. R. (1932). *J. comp. Path.* **45.** 172.
WILLIS, R. A. (1948). "Pathology of tumours." London. Butterworth & Co. (Publishers) Ltd.

THE OPENER'S SPEECH

Mr. J. Allcock, in opening the discussion said: I would like first of all to thank Mr. Cotchin for his paper and slides and to congratulate him on presenting such a mass of information in such a digestible form.

In opening the discussion on a paper like this I am, using a horticultural metaphor, somewhat in the position of a gardener growing a rather rough lot of potatoes, while over the fence Mr. Cotchin carefully and precisely tends his orchids. But the same sun shines on both of us and should there be a passing bird trouble can descend on us each alike.

It might be said of this paper, it is very interesting but what is its value to the clinician? First and most important, it gives a fairly accurate impression of the incidence of neoplasia in the dog with regard to age and breed, and also the incidence of the various types of neoplasms and their situations. It is a very true maxim to diagnose rare things rarely and Mr. Cotchin has indicated the pattern of these rarities.

In commenting on the figures of incidence given by Mr. Cotchin I can only, in the main, offer impressions. In the case of tumours of the mouth my experience in Bristol is that the tonsillar epithelioma is rare. The commonest mouth tumour is the so-called "epulis" on the gum. Mammary tumours appear to occur more frequently in bitches from spaniel size downwards. The Alsatian, a common breed here, seems to be singularly free from them, and I have never seen one in a greyhound bitch. A lot of these dogs do not, however, survive to tumour age, although the old, retired, greyhound dog seems to get his share of anal adenomata. I have not noticed any association between pyometra and mammary tumours, nor any history of abnormal oestrous cycles, but I think there is a higher incidence in the maiden bitch and possibly in the bitch who has shown a fairly marked development of the udder in pseudo-pregnancies. Existing tumours appear to grow more rapidly in the pseudo-pregnant phase. Mr. Cotchin's figures of the incidence of neoplasia in the dog seems a little high. In 1,300 dogs we saw for all reasons, there were only 60 tumours, something under 5 per cent., that is clinically diagnosed tumours and not tumours diagnosed at *post-mortem*. Possibly it would have been higher if dogs destroyed because of senility had been examined *post-mortem*.

Of the 60 cases in which neoplasia was diagnosed, the age was known only in 39, the average being 8.6 years, almost the same as Mr. Cotchin's average in his very much larger number. The distribution of these tumours followed a very similar pattern: 26 (or 42 per cent.) in the cutaneous system, 12 (or 19 per cent.) in the mammary gland, and 11 (or 17 per cent.) in the alimentary system. There was only one tonsillar epithelioma, but four carcinoma of the liver and none in the intestines. Two neoplasms frequently seen were the anal adenoma and prostatic enlargement; whether the latter is a neoplasm, as classified by Mr. Cotchin, I do not know. He mentions adenoma of the prostate but I do not know whether this is the same as benign hypertrophy.

In the 1,300 cases there were 27 cases of pyometra but only one in which there was a history of previous or (2 years) subsequent mammary neoplasia.

Clinically we have to divide tumours into two main groups, the cutaneous or immediately sub-cutaneous ones, *i.e.*, external tumours, and those in the internal organs of the body. The first group presents little difficulty in primary diagnosis, it is fairly easy to say "this is a tumour," but a more precise diagnosis, which is the same thing as the prognosis, in most cases is difficult We have to answer to ourselves and to the owner the following questions:—

Should it be removed? If it is removed, will it recur, either at its present site or elsewhere? Is any other treatment possible?

In general I would answer "Yes" to the first question, except for the following:—

Firstly, those cases that for their own sakes are better destroyed,

Secondly, the old, almost senile dog who can live happily with his particular lump or bump for some few months and will then die or be destroyed because of senility or some intercurrent disease.

Thirdly, anal adenomata in dogs of almost any age are better treated with oestrogens. This is almost invariably effective in reducing the size of the tumour and in checking the haemorrhage which occurs and so often is the reason for the owner bringing the dog to us.

Recurrence

There will be a recurrence but further oestrogen treatment will deal with it; and a large proportion of these neoplasms recur after they are removed surgically. Whether more drastic surgery in the first case would prevent this I do not know. I have made some large holes in the anal region of dogs and have been convinced that all the neoplastic tissue has gone only to see him six or eight months later with an even larger tumour. The occasional case which does not benefit by stilboestrol by mouth will often benefit by the implantation of three or four 15 mg. tablets in the region of the tumour, using an ordinary caponising gun. Castration must be considered but the suggestion of this often meets with opposition from the owner.

The epulis on the gum is best left severely alone unless it is in such a position as to interfere with feeding or it is seriously displacing the teeth, but even in this case removal of the teeth is a better procedure. Surgical interference with this growth often exacerbates the condition. Similarly, the infective multiple papillomata in the mouth of the young dog are best left alone unless they cause trouble mechanically. Spontaneous disappearance is the rule rather than the exception and medical treatment is, I believe, of more value to the day book than to the dog.

Multiple warts on the back of the old Scottie are best dealt with only as an individual wart begins to bleed or becomes a source of irritation. In fact, some are so extensive that their complete removal would involve a virtual skinning of large areas of the dog. Incomplete removal is probably dangerous, if we can draw a parallel from the human where malignant melanomata tend to develop following interference with benign ones that have existed for years.

And of course, the very small mobile tumours seen casually when an animal is presented for some other reason are best not touched, but even in these cases it is well worth advising that if it enlarges advice should be sought. I am not suggesting that we should make mountains out of molehills but these molehills can and do become mountains, often too large to tackle when they are next seen.

This may seem a large list of neoplasms to leave alone, but the remainder of the external tumours should I believe be removed when seen. Mammary tumours, especially, can be of such mixed structure and can so rapidly become, if not malignant, so extensive as to demand very major surgery on a middle-aged or old bitch where 12 months earlier a much less extensive operation could have been performed on a younger animal. The frequency with which surgery becomes necessary because of the size of the tumour alone, apart from malignancy, justifies the earliest operation possible.

These remarks apply equally to other tumours. I recently operated on a retriever with a carcinoma in the neck. Eight weeks later I tried again, and six weeks after that I destroyed the dog because of metastases in the adjacent glands and a large mass at the initial site. This dog had a small lump on the neck for four years to my knowledge, a nice little lump to remove but it was never done. Had it been dealt with when it was first seen he would have been alive to-day. It may be that some clinicians can differentiate these neoplasms and pick out those which can be safely ignored, but I cannot.

It sounds an attractive idea to perform a biopsy and have a pathologist's report, but bearing in mind the mixed structure of mammary neoplasms especially, I think reliance on a small portion selected at random can be dan-

gerous. I recently removed a mammary tumour and sent it to one of the colleges for routine sectioning. In due course the report came—"an adenoma." A little later a further report arrived: "On taking further sections for class purposes, areas were found of the appearance of an adeno-carcinoma." I do not mention this as a gibe at pathologists, all honour to this particular laboratory for their second report, but I think we clinicians are too inclined to pin our faith too much on pathologists' reports and to read into them more than is intended. If there is any possibility of a mixed tumour, great care must be taken when a pathologist's report is read.

Turning to the internal tumours, here the diagnosis of the presence of a tumour can be difficult, apart from a more precise diagnosis of its type and position. The greatest difficulty is in the old bitch presented with thirst and abdominal enlargement. Carcinoma of the liver, pancreas, lymphosarcoma of the mesenterics, neoplasms of the spleen, nephritis, pyometra and ascites from any cause must be considered. Clinical examinations, radiological examinations, laboratory examinations, can all be employed and a satisfactory diagnosis not reached. In these cases I believe the next procedure should be an exploratory laparotomy, first obtaining the owner's consent to destroy the dog whilst under the anaesthetic if necessary. In my opinion, clinical examination of the abdomen is never completed until a satisfactory diagnosis has been achieved, or an exploratory laparotomy has been performed. A high proportion of these cases prove to be malignant neoplasms or untreatable liver disease but the few that can be saved and the accurate diagnosis of the remainder amply repay the trouble taken. The odd case recovers after operation for no known reason, and at least the dog has had a chance of life.

Pulmonary neoplasms cannot be confirmed in this way but they are almost invariably secondary and the knowledge of the primary lesion can be helpful. Radiology is of the greatest value in diagnosis of these pulmonary neoplasms. Cerebral tumours are another difficult diagnosis and here hospitalisation for a period to allow for adequate observation is an essential.

A discussion of this nature is not complete without a speculation (and it cannot be more) as to the origin of tumours. In the dog, at least, sex hormones might seem to play an important part. Oestrogens cause a regression of the anal adenoma and of hypertrophy of the prostrate; I have also found them useful in rodent ulcer in the cat. Is some excess of male hormones responsible, and is the high incidence of mammary neoplasia connected with the fact that the mammary gland is under the influence of progesterone for almost a quarter of the life of the bitch?

Yet I have noticed that a dog with tumour of the testicle becomes attractive to other dogs which suggests that some female hormone is being produced. I have never attempted to treat testicular tumours with oestrogen but I should be interested to know whether it is possible to do so successfully. Is trauma a factor in sarcoma of the limb bones in the large breeds? Not necessarily the trauma of an actual blow but trauma caused by too much weight on a leg not built to take it.

In conclusion, I must thank the Committee for their invitation to me to open this discussion. I do not know why I was chosen, there are many others who were better qualified to do so. I hope we are about to hear from them.

The Chairman said that two interesting presentations had been given of this subject from two quite different points of view. A great many matters had been raised which were controversial and this should give rise to a very lively discussion.

THE GENERAL DISCUSSION

Miss J. O. Joshua (Finchley) added her thanks and congratulations to the author and the opener on a subject which was of vital importance not only in the veterinary field but in the comparative field. It was extremely fortunate that there were in this country pathologists who had taken an interest in this subject; Mr. Cotchin was rapidly becoming an international authority on animal neoplasia.

She thought it was probable that the general extent of neoplasms mentioned in the paper would cause comment.

Mr. Allcock's figures were obtained in private practice and she suggested that the difference was that in private practice one probably saw a higher proportion of old animals than was usual in college or hospital clinics. Her most recent up-to-date figures on a relatively short series were that 54 out of 345 dogs examined had some form of neoplasm which worked out at about 12.7 per cent. This included everything which could be termed "neoplastic," even the smallest of ordinary papillomata and this figure did suggest that dogs bore a very heavy incidence of tumours.

Mr. Cotchin had mentioned rib sarcomas as being fairly common bone tumours and that they were usually rapid in growth in young dogs. She could recall one case where the owner said that the dog had been involved in a street accident at 18 months and from that time it had a small lump on its ribs. The tumour grew extremely slowly until the dog was destroyed at 10½ when the neoplasm had invaded the greater part of the chest cavity.

A point which had interested her very particularly lately was the fact that in any given animal one often found a multiplicity of tumours, very often of different types. She could not help feeling that if one knew why this was it would have some bearing on the fundamental aetiology of cancers. Just to mention a few cases, one seen recently was an eight-year-old Kerry Blue bitch with the following:—

One lump on which she had not yet had a report, probably an adenoma arising from a sebaceous gland, there was also a small mammary nodule, a papilloma on the shoulder, and a granuloma below the hock.

A very old cross-bred terrier, about 16, with a testicular tumour, had also a papilloma over the left hip, and a circumanal adenoma; a 12-year-old bitch had a sebaceous lesion, a mammary nodule, a melanoma and a thyroid tumour. Finally, a spaniel now eight or nine years old had numerous papillomata, a circumanal tumour and a fibrous epulis. These were a few cases out of many and it did appear that if a dog had a tendency to produce tumours it could produce them in a variety of tissues.

She was not inclined to agree that mammary tumours in Alsatians were rare, she had seen a number, nor would she agree with regard to surgery of anal tumours and epulidae; when one was forced to remove the circumanal adenoma on the whole the tumour did not tend to recur on that site. The fact was that the dog produced circumanal adenomata, it might therefore produce other tumours round the anal ring but not a recurrence at the original site. If there were malignant changes an epulis would recur, but she thought it was worth while removing areas of localised fibrous tissue and if it was done thoroughly there was not a recurrence.

Miss M. Freak (Potters Bar) said that on the question of the rib tumour and the rate of growth a case which she could recall supported what Miss Joshua had said. She did not think there was a definite history of accident when the growth began at the age of two years; she eventually destroyed the dog at the age of 11. It was a Cairn terrier and by that time it had a six-inch diameter lump on its side and the inside of the chest. The mass almost filled the chest cavity. The most noticeable thing was the pushing of the heart right up against the chest wall, the heart beat was very noticeable, shaking the right side of the dog's chest. The neoplasm caused no pain and the cardiac embarrassment was the eventual reason for destruction.

The only other comment she had to make on Mr. Allcock's contribution was on the question of when to operate or not to operate on the mammary tumour in the bitch.

It was her experience that cases of mammary tumour were mostly brought in during the pseudo-lactation period when they were obviously enlarging. If this enlargement, however, was not too rapid she preferred to defer surgery until the mammary gland was quiescent when the surgical field was not obscured by milk and when areas of simple inflammation as opposed to neoplasia would have disappeared. The surgery was easier and healing more rapid and the problem of dead space considerably less.

Miss M. V. Levie (Bristol) said that until two years ago she was in practice in the same city as Mr. Allcock and her remarks arose out of a practitioner's imagination. She would agree that in the 11 years in Bristol she had seen only one case of carcinoma of the tonsil. Mammary tumours she thought were definitely associated with pyometra; a large percentage of cases presented with pyometra had some small mammary tumour present. With regard to lymphosarcoma, in the last two years at Bristol University there had been quite a large percentage of cases. She thought diagnosis should definitely be based on a biopsy. She knew the difficulties from the pathologist's point of view of getting sections through but she still thought it should be done.

Mr. O. F. Jackson (Darlington) said that he had a slightly different story in the north with regard to tonsil carcinomas. He seemed to find carcinoma of the tonsil on an average of two cases a year. His particular area was not specially industrial so that he could not suggest any cause. One sometimes found multiple mammary tumours in various stages and he felt that whether one decided on surgical interference or not it was really a case of choosing the subject. Sometimes one had a number of small mammary tumours, perhaps as many as six, with one outstanding, and if one attempted to remove it surgically it seemed to produce the stimulus for the enlargement of the others. This was one of the cases where one should not attempt surgical removal. He agreed with Miss Levie that very often cases of pyometra had a small nodule in the mammary glands; that was another point on which he disagreed with Mr. Allcock.

Mr. K. Vaughan, B.V.SC. (Liverpool) congratulated Mr. Cotchin on his paper and especially on his X-ray pictures. (Mr. Cotchin: They are Mr. Knight's X-ray pictures). They were what he would expect from London University and he wished he could emulate such X-rays in practice. On a rather worn set the difficulties of taking bone X-rays were quite considerable. He was thinking of the bone sarcoma in the large breed of dog, the Great Dane or the St. Bernard. He was often tempted to think at first that it might not be a bone tumour but an injury involving the periosteum. As an X-ray may not be diagnostic he found it helpful to give the owner a piece of string to put round the leg. The increase in circumference could be demonstrated after about three weeks.

He suggested that some inter-digital cysts may be neoplastic in origin.

He commented on Miss Levie's suggestion that a biopsy was necessary for diagnosis and on Mr. Jackson's remarks, and agreed with those who suggested that surgical intervention may act as a stimulus to the rapid formation of new growth.

Mr. Alexander Thomson (G'asgow) said that there was one point he wished to put on record as an observation in connection with the metastatic spread to the lung. At some period in the illness there was a period where there was a rise of temperature which settled down later, and at *post-mortem* one found metastases in the lung.

Miss Levie said that she did not wish to convey the impression that one should make indiscriminate incisions into tumours and send little bits away but one should send a portion of the tumour removed surgically. If a biopsy was done on a living animal—it was usually the malignant tumours which grew rapidly—and a positive answer was received one was in a far better position to deal with the case.

The Chairman said that he considered that a biopsy would be a perfect thing to do in a perfect world, but in practice it was often difficult, in many cases it was much easier to do the final operation. In the school at Glasgow a biopsy was done because there was not the same immediate pressure that there was on a practitioner in practice. He was of opinion that there was a great deal of evidence that interference did cause trouble. One often found the type of tumour which Mr. Cotchin showed in cross section, the little skin fibromata with melanotic infiltration which did tend to become malignant, particularly if they were injured. One found the same type in the intradigital region.

In many of these cases the dog had been subject to interdigital cysts and the owner had in the first place presumed that the tumour was merely an interdigital cyst which was slow in healing.

Mr. J. S. J. Lauder (Altrincham) asked with regard to the question which Mr. Jackson brought up about the multiple mammary tumour where the removal of the major tumour stimulated the minor secondaries to grow, whether there was any connection between that and the suggestion made by Mr. Vaughan and Miss Levie that a biopsy caused an increase in the present tumour.

The Chairman, on the point of whether one should operate or not, said that when he was in practice he often sent specimens away for a report and the reply in many cases of what clinically appeared to be tumours was "mammary hyperplasia" and he did not know what to do. At one time he removed a great many of these but he came to the conclusion that if these swellings occurred during the post-oestrous period and then settled down in eight weeks it would be safe to leave them alone, but if the swelling had doubled in size in this time he removed it. If operation was decided on he removed a considerable part of the mammary gland and in many cases all the gland at one or two operations. Otherwise recurrence was usual. In many cases he had operated on dogs up to eight years and they would go on to 10, 12 and 14 without recurrence.

Dr. W. v. Düring (Berlin) asked if anybody in this country had tried treating epidermal cancer with X-rays. She had one case of a dog of two years old who developed cancer in the femur and the owner was advised to have the dog destroyed. Because the dog was young the owner asked that everything possible should be done and she succeeded in finding a human radiologist who was interested in the case and he gave the treatment to the dog. It had two treatments a week for a month and the tumour was reduced to almost nothing, the dog was free from pain and fever. There was, however, a relapse after four months, further treatment was given, the dog relapsed again, and again treatment was given. Presumably this could continue indefinitely, and it seemed as if it would be possible to hold a valuable dog for a time by this method.

The Chairman said that Mr. Gordon Knight in London treated a number of dogs with malignant bone tumours with X-rays and obtained some regression, but the end result was usually the development of spontaneous fractures.

Mr. Cotchin said that occasionally of course lung metastases appeared. It was possible to sterilise the local tumour by X-rays but the dog died or had to be destroyed with secondaries in the lung. It was not always possible to say whether the dog had secondaries at the time of treatment, as they could not be picked up by X-rays if they were very small. The general practice was that if the diagnosis of bone sarcoma was made the dog was destroyed.

Mr. Allcock said that he was inclined to agree with Miss Joshua that anal adenomas did not recur at the same site, but from the point of view of the owner they still recurred under the tail. This was one of the tumours for which there was medical treatment and he was inclined to believe that oestrogens prevented recurrence so long as treatment was continued. They were better treated by oestrogens than surgery.

Mr. Lauder answered Mr. Jackson's point but he would like to say that if there were one or two mammary neoplasms present the right procedure was to remove the whole of the gland on that side and if the operative shock was not too great on both sides.

Miss Levie had mentioned biopsy and suggested that if it was a malignant tumour the biopsy might make it more so and necessitate destruction earlier. He could not agree with that, because he had found even in a malignant tumour there was a stage where it could be removed surgically successfully, or sufficiently successfully as to give a considerable period of life before destruction became necessary.

Miss Freak had mentioned the time of operation for mammary tumours: he thought if milk was present in the glands one was better advised to wait, if milk was not present, regardless of the time of oestrous the time of operation was there and then.

THE REPLY

Mr. Cotchin, in reply, said that a number of points of tremendous interest had been made, and he would refer to one or two. First the question of tonsil carcinoma—it looked as though London was an area where dogs were particularly prone to carcinoma of the tonsil. He understood that in Belgium and America it was not common; it was rare in Bristol, and Mr. Jackson in Darlington saw only two cases a year. It looked as if the distribution of carcinoma of the dog's tonsil in this country should be investigated. He would be glad to collaborate with anyone who would follow that question a little further.

With regard to biopsy, someone had suggested that the pathologist's report was sometimes not of much value to the clinician. He thought that it was very valuable to the pathologist, who, by examining a very large number of specimens in collaboration with the veterinary surgeon who provided the whole pre- and post-operative history, gradually acquired information from which a definite diagnosis of value to the practitioner in future cases could be made. The histology of a dog's tumour might be the same as in man, but the prognosis might be different, and only experience could show that. "Biopsy" he took to mean the examination of the whole tumour removed at operation in most cases, but there was one field in which biopsy was very useful, and that was in the diagnosis of "pseudo-Hodgkin's disease" in the dog. It was usually of no diagnostic value to examine the blood, but it was very valuable to examine an enlarged node histologically. Miss Joshua, who was one of those who had helped him enormously in his study of dog tumours, had referred to the frequent occurrence of multiple tumours in one animal. One had to distinguish between benign and malignant tumours; many dogs might have multiple benign tumours, but not many dogs would have multiple primary malignant tumours.

In regard to prostatic enlargement, the adenoma mentioned in the table was not the adenomatous hyperplasia, which one did not think of as a tumour; this hyperplasia was extremely common in dogs but clinically and pathologically prostatic carcinoma was a rarity.

With regard to stimulation of tumour growth by operation, biopsy or removal, there had been some work done on that but he would not like to say what the explanation might be. Melanomas were mentioned sepcifically and if these were removed or maltreated they were thought sometimes to become malignant. The difficulty was to know whether the tumour was benign before it was removed or maltreated and the reason that apparently benign melanomas were taken off might be because they were already malignant and became irritant.

He had enjoyed the discussion very much and had got a lot of ideas out of it for further study if not elucidation.

The Chairman said that the discussion had been stimulating and it had been interesting in the different points of view expressed. Mr. Cotchin deserved all their thanks; his work in connection with neoplasia of the dog was known and he now had gone further along the road in attempting to ascribe the reasons for the variations in occurrences. On behalf of the meeting he thanked him very much indeed.

News and Comment

ANNUAL DINNER AND DANCE OF THE NORTH WALES DIVISION

About 140 members and their friends attended the fifth annual dinner and dance of the North Wales Division at the Imperial Hotel, Llandudno, on December 3. The party, which included the President of the N. Wales Branch B.M.A. and representatives from the South Wales Division, B.V.A., heard Professor Robertson, President of the B.V.A. propose the toast of the Division, the reply being made by Mr. Wyse, President of the Division. Mr. E. B. Jones proposed the toast of the Ladies and Mrs. Lornie replied. At the close of the dinner an impressive list was read of gifts donated by the drug firms advertising in THE RECORD; most of these were won in competition during the dancing which followed dinner, but a few were "seized" by members of the Ladies' Guild and raffled in aid of the Benevolent Fund. This, in addition to the draw for their Christmas raffle held during the evening, produced some £40.

COMING EVENTS

Dec. 30th.—Annual Dance of the Ladies' Guild, Dumfries and Galloway Branch of the V.V.B.F., in the Cairndale Hotel, Dumfries.

Jan. 4th.—14th Ordinary General Meeting of the A.V.T. and R.W's. at the University of Liverpool Veterinary Field Station, Leahurst, Windle Hill, Neston, Wirral, Cheshire, 10.30 a.m.

Jan. 6th.—General Meeting of the Central Division, B.V.A., at the Royal Veterinary College, Camden Town, London, N.W.1, 5.30 p.m.

Jan. 12th.—Meeting of the R.A.V.C. Division, B.V.A., at Boots Pure Drug Co. Veterinary Science Division, The Priory, Thurgarton, Notts, 12 noon.

Jan. 12th.—Meeting of the Supplementary Veterinary Register Division, B.V.A., at the Council Room, R.C.V.S., 9-10, Red Lion Square, London, W.C.1, 1.45 p.m.

Jan. 13th.—Ordinary General Meeting of the South-Eastern Division, B.V.A., at the Royal Star Hotel, Maidstone, 2.30 p.m.

Jan. 27th.—Annual Dinner-Dance of the North of Scotland Division, B.V.A. (in aid of the Victoria Veterinary Benevolent Fund), in the Northern Hotel, Aberdeen, 7.30 p.m.

B.V.A. QUARTERLY MEETINGS

The arrangements for January are:—

Wednesday, January 19th.

10.15 a.m. Organising Committee.
2.0 p.m. Home Appointments Committee.
4.0 p.m. Parliamentary & Public Relations Committee.

At 7, Mansfield Street, W.1.

Thursday, January 20th.

10.30 a.m. Veterinary State Medicine Committee.
2.0 p.m. General Purposes & Finance Committee.

At 7, Mansfield Street, W.1.

Friday, January 21st.

10.30 a.m. Council meeting.
At the Connaught Rooms, Gt. Queen Street.

PERSONAL

Birth

VICKERS.—On December 9th, 1954, at Black River Hospital, Jamaica, to Margot, wife of Colin Vickers, B.V.SC., M.R.C.V.S., a daughter—Margot Ann.

R.C.V.S. EXAMINATIONS

University of Glasgow Veterinary School

Fourth Year—Harrison, Thomas C.

Final—Crawford, Thomas C.; Gracie, David K.; Loudon, Alistair J. B.; Martin, (Miss) Heather; Torrance, Douglas S.

MYXOMATOSIS ADVISORY COMMITTEE

The Minister of Agriculture and Fisheries and the Secretary of State for Scotland have appointed Earl St. Aldwyn, T.D., Joint Parliamentary Secretary to the Ministry of Agriculture as Chairman of the Myxomatosis Advisory Committee in place of Lord Carrington, M.C., who is now Parliamentary Secretary to the Ministry of Defence. Mr. I. Thomas, M.SC., PH.D., Deputy Chief Scientific Officer to the Ministry, has also been appointed as a member of the Committee in place of Mr. J. W. Evans, M.A., SC.D., D.SC., who has taken up an appointment in Australia.

The filling of other vacancies on the Committee is under consideration.

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax :

Northumberland. Tranwell Farm West, Morpeth (Dec. 13).

Yorks. Graham House, Marrick, Richmond (Dec. 13); High Austby Farm, Ilkley (Dec. 14); Elmsall Lodge Farm, Badsworth, Pontefract (Dec. 16).

Fowl Pest :

Cambs. Westfield Poultry Farm and 35 Westfield Road, Manea, March (Dec. 14).

Norfolk. Hill House, Garveston, Norwich (Dec. 14); Buddleia, Clint Green, Yaxham, Dereham; Guntens Farm, Reymerston, Norwich (Dec. 15); Brookside, Breckles, Attleborough (Dec. 16).

Suffolk. 32, Turnpike Road, Red Lodge, Freckenham, Bury St. Edmunds (Dec. 16).

Yorks. The Pines, Marton, Sinnington (Dec. 13).

Swine Fever :

Ches. Promised Land Farm, Rowton, Chester (Dec. 15).

Denbighs. Home Farm, Llay, Wrexham (Dec. 16); Lower Eyton Farm, Eyton, Wrexham (Dec. 18).

Flints. Tyddyn-y-Foel, Cilcain, Mold (Dec. 18).

Glam. Highmead Farm, Birchgrove, Nr. Neath (Dec. 17).

Lancs. Ivy Farm, Chorlton Green, Manchester, 21 (Dec. 14).

Leics. Church Lane, Swannington (Dec. 14).

Monmouth. Home Farm, St. Cadoc's Hospital, Caerleon, Newport (Dec. 14); Lower Stanton Farm, Llanvihangel Crucorney, Abergavenny (Dec. 18).

Salop. The Cinders, Minsterley (Dec. 17).

Staffs. Scott Lidgett Road Allotments, Longport, Stoke-on-Trent; Bank House Farm, Hyde Lea, Stafford (Dec. 14); Thorneyfields Farm, Thorneyfields Lane (Dec. 16).

Suffolk. Hill Brow, Withersfield, Haverhill (Dec. 16).

Surrey. Scotland Farm, Vale Road, Ashvale (Dec. 17).

Worcs. Merry Oak Meadows, Feckenham, Redditch (Dec. 16).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

A LEGITIMATE GRIEVANCE

Sir,—It is time the Royal College realised that the whole body of practising veterinary surgeons is behind the plea for action in the question of the privileges and unprofessional liberties of the various societies for the treatment of animals. The profession is a silent one on the whole, but our voice is surely audible, though we have not all written to express it.

The profession has only itself to blame, however, if, by adopting big business principles, the "long standing tradition" of benevolent humanitarianism is lost and the animal welfare societies spring up to fill the vacuum.

Yours faithfully,

W. J. McK. McCORMICK,

"Crosshaven,"
Reading.

December 6th, 1954.

Sir,—May I through your columns beg to criticise those whose names are entered on the Register, more especially on the Supplementary Register I regret to say, and who are permitted to aid and abet free clinic organisations in their advertisements through such mediums as the Press and television (Friday, December 10th at 5 p.m. for example).

By what right, as a point in our professional laws (Veterinary Surgeons Act of 1948) are they allowed to aid advertisements without censure whilst private practitioners cannot even advertise ' boarding kennels ' on headed notepaper to people who are already their clients?

We all know free clinics are far outstepping their margin of rendering first aid to animals, treating only poor people's animals (do poor people exist other than old-age pensioners who have no other means of support?) and investigating complaints of cruelty. Are we doing nothing to prevent our livelihood, with regard to small animals, being completely taken away?

Yours faithfully,

R. HODDINOTT,

55a, Kenilworth Road,
Leamington Spa,
Warwicks.

December 16th, 1954.

PARTURITION IN THE PIG

Sir,—All who are interested in the physiology of reproduction will appreciate the article by J. S. Perry, based on practical observation, which appeared in your issue of November 13th. He has drawn attention to the great length of the umbilical cord in the piglet, to the freedom with which it is able to move inside the uterus and to its ability to reach the outer world with cord intact.

The piglet is somewhat remarkable in that it is nourished throughout the greater part of its intra-uterine life by the secretion of uterine glands, transmitted to the foetal blood stream by means of trophoblastic cells of extra-embryonic origin which eventually develop into the primitive chorion. In the calf and lamb, it is believed that means of nutrition is discontinued much earlier so that in the case of the piglet it is essential that the chorion should make a wide contact with endometrial villi.

In the sow, the chorion is laid down over the *whole* of the endometrium commencing at about the 10th to 15th day of pregnancy and is followed by deposition of the allantois at the third week. The amnion then develops from the hinder gut and surrounds the embryo and, in the case of the sow, becomes adherent over a small portion of its surface to the allantois. The pregnant uterus of the sow, supported by the metromesum, is thrown into a number of wide convolutions and the cavity of the uterus consists therefore of a number of pouch-like cavities containing the piglets, the limitation of each being *incompletely* determined by each adjacent constriction.

The sow, unlike the bitch, which has a zonary deciduate placenta, possesses an undeciduate placenta of the diffuse type in which the *entire endometrium* is involved, so that any breaking up of the allantoic cavity into separate sacs observed at the time of parturition is more apparent than real.

When parturition commences in the sow it is thought that some degree of degeneration of portions of the amnion has already occurred and that the movements of the piglet, very active at this stage, effect rupture. These also help in bringing about detachment between the amniotic and allantoic layers with the result that the piglet, still anchored loosely and maintained by its long umbilical cord, is free in the uterine cavity. The chorion is still practically intact and attached to the uterine mucosa, not in one smooth sheet but following the inner surface of the uterine convolutions. The result of this is that the birth of each piglet may be followed by the expulsion of the amniotic membrane or a succession of piglets may be followed by a succession of membranes.

The main point is that the chorionic membrane, the allantochorion, which still remains, does not always become detached before the rapid contraction of the uterus has been accompanied by a similar closure of the cervical orifice. It is this holding up of the continuous placental membrane which gives rise to serious maternal mortality.

So far, I know of no remedy for this condition and I shall be very pleased if any of your readers can supply the solution.

Yours faithfully,

R. H. SMYTHE,

The Park,
Nottingham.

November 13th, 1954.

WARBLE-FLY INFESTATION

Sir,—In this practice, following the recommendation of Menon (1951), the work of Sumner (1951) and of Crawshaw (1952), we have treated a number of cases of multiple papillomata in the bovine with lithium antimony thiomalate (Anthiomaline). Most of these cases have been in the summer months, and we have been consulted because of, or the possibility of, severe maggot infestation. Results in our cases amply justify the claims of previous workers.

In April, 1954, we were called to treat a two-year-old Hereford heifer suffering from multiple large papillomata of the face and neck. We noticed at the first visit that this animal was severely affected with warble larvae. Four injections were given commencing with a dose of 10 c.c. and increasing every three days until a dose of 20 c.c. was reached. Results were satisfactory and considerable contraction of the warts took place. Some warts were shelled out at the time of the last injection and the remainder seven days later with very little haemorrhage. At the time of the third visit several mature warble larvae were expressed from the back and it was found that these showed no movement. (They failed to curl up and showed no response on being sectioned). This was repeated at the time of the final visit and no live warble larvae could be detected.

Owing to the considerable interest at present shown in the prevention of damage to hides and unthriftiness in cattle during the late winter, due to heavy warble fly infestation, it is suggested that Anthiomaline by injection be given a trial.

Yours faithfully,

RICHARD H. C. PENNY,

The Black Lion Yard,
High Street,
Leighton Buzzard, Beds.

December 7th, 1954.

References

MENON, M. N. (1951). *Vet. Rec.* **63.** 49.
SUMNER, G. R. (1951). *Ibid.* **63.** 722.
CRAWSHAW, H. A. (1952). *Ibid.* **64.** 596.